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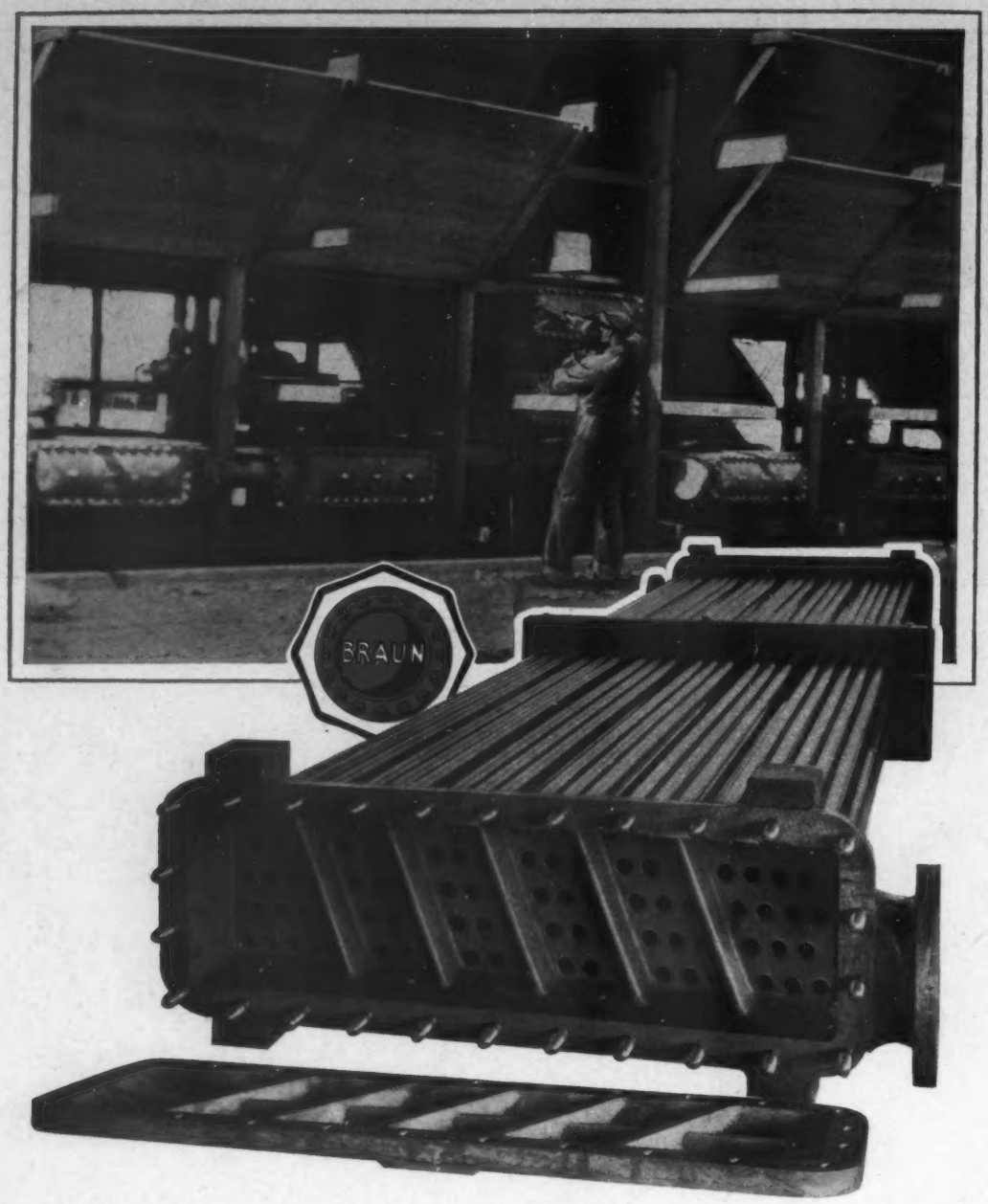

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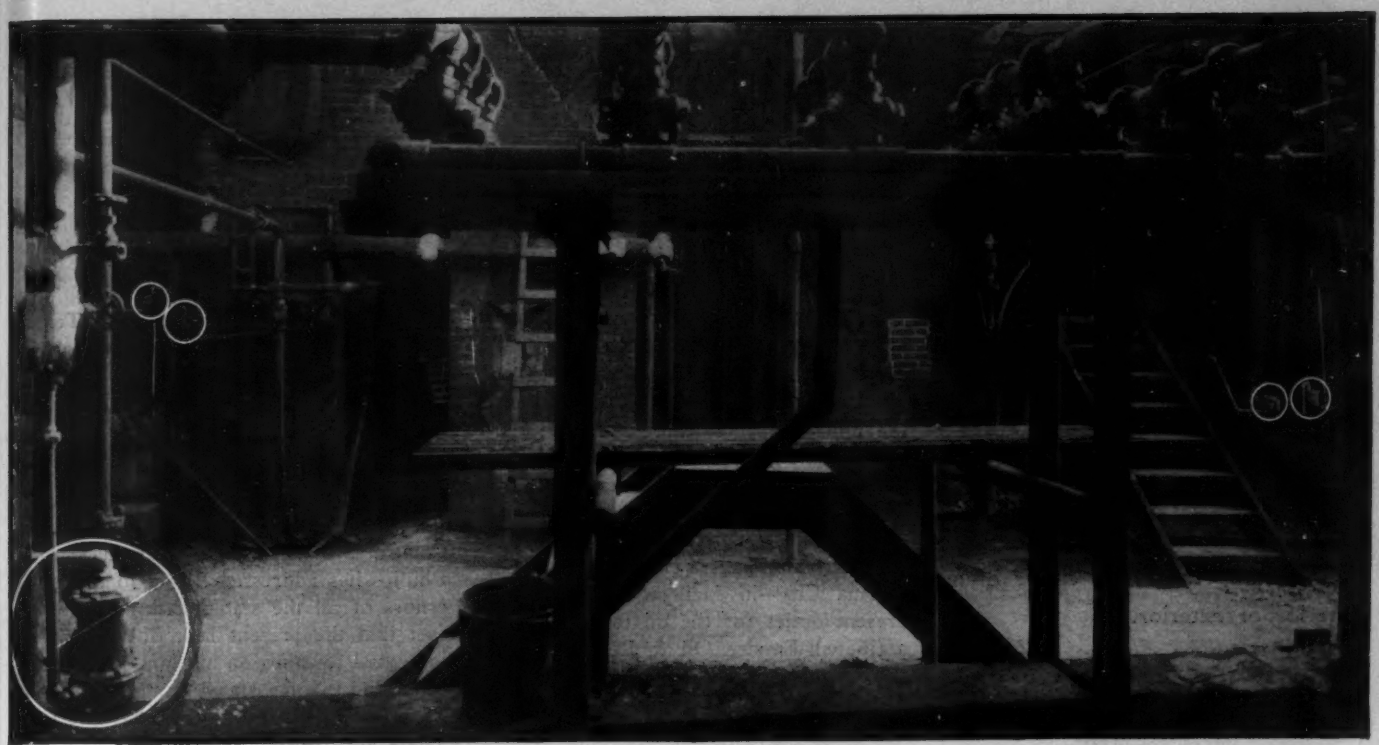

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Refinery that used cracked valves for years found that there is a foolproof steam trap

The No. 30 Armstrong trap meeting the demand for a small, efficient and inexpensive trap.

The No. 31 Armstrong trap —ideal for draining small steam heated units.

UNWILLING to risk ordinary steam traps, the engineers of one refinery had used cracked valves for years to drain condensate from separators on steam lines to stills. The outstanding performance of Armstrong inverted bucket steam traps was called to their attention; they installed No. 30, 31 and Special traps as shown in the illustration; and their worries over slugs of water getting into stills ended.

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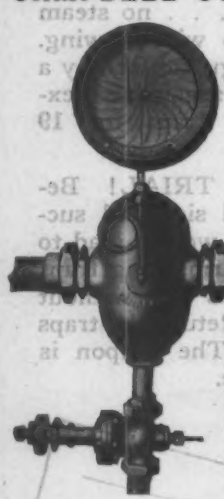
CAMPBELL STEAM FLOW CONTROLLERS



on page 93 of the Jan. issue of *The* REFINER:

"... it controls and records steam flow at the desired rate, thus taking the guess work out of steam injection into low pressure vessels used in process work. Such a practice results in direct savings in steam, fuel, and labor, and eliminates the necessity of guessing at the amount of steam to be used in a given still or process."

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THE MONTH IN REVIEW

In the following columns will be found a brief digest of happenings of interest to refiners, with even reference to a rumor or two!

CITIES Service may be planning a plant on the Houston Ship Channel. As rumors go, the logic is that a line will be laid from Oklahoma City to deep water at the inland seaport where in addition to serving the proposed plant, water shipments of crude could be made to units of the Doherty organization on the East Coast. Indian Territory Illuminating Oil Company may have a lot of crude in Oklahoma City—in fact probably has, and present outlet for the oil to plant of its affiliated Empire Oil & Refining Company is to Mid-Continent plants and crude handled through the Texas-Empire line to Chicago is no closer to Boston in Chicago than in Oklahoma. More to favor the proposition is that there is plenty of room for refineries below Houston, and oil companies with pipe lines across the wide expanse of Texas notably have been showing encouraging figures on balance sheets.

GASOLINE pipe lines are becoming epidemic. One of the latest is that of Magnolia Petroleum Company from its Fort Worth refinery to Dallas. Previously the same company announced plans for a line to handle motor fuel from Luling to San Antonio. Piping gasoline is no experiment with this company as it handled both gasoline and kerosene from Beaumont to Sabine Pass for many years previous to construction of the Beaumont ship channel which brought sea boats to the refinery docks.

THE Texas Company proposes to have special fuel for the packard Diesel airplane engine at 300 points in the United States immediately, at or near airports, and in every section of the country as the new engine's distribution demands it. It was said that engineers of The Texas Company have been working on the fuel for this engine along with the makers of the engine since early in its development. The new fuel is said to be plentifully available and is particularly adapted to aviation conditions, not being affected by extremes of temperature and is non-explosive, practically eliminating the fire hazard. Announcement of the new fuel was made from San Diego, California, by Captain Frank M. Hawks, superintendent of the aviation division of The Texas Company, as he was taking off for his transcontinental glider flight.

UNIFORM taxation for gasoline used in airplanes is the plea of Frank Phillips, president of Phillips Petroleum Company, Bartlesville, Oklahoma. Mr. Phillips has addressed letters to the governors of all the states setting forth the fact that the present lack of uniformity in regard to taxes on airplane gasoline is confusing. Some states impose a tax on gasoline for this use. Others have no tax. There are differences in rates among the states. Replies received thus far indicate that the governors are in accord on the matter of uniformity, although there is as yet nothing as to what this uniformity should be. Whether there should be a tax on airplane gasoline, or whether it should be exempt from the tax are matters to be decided later. In his letter Mr. Phillips set forth the fact that 40,000,000 gallons of gasoline were used in airplanes in 1929, with the prospect for twice that amount in 1930.

ANOTHER name long familiar in the oil business began to fade from the picture April 1 when the name of Shaffer Oil & Refining Company was changed to Deep Rock Oil Corporation. The name is not new, as a marketing subsidiary has been operating as Deep Rock Oil Company and featuring Deep Rock as a trade name, as has High Test Oil Corporation, another marketing organization which now also is absorbed as to name. The company is a unit of Standard Gas & Electric Company of Chicago; general headquarters are at Tulsa and general sales offices in Chicago. The refinery, at Cushing, Oklahoma, is a complete unit rated at 10,000 barrels daily and has 3800 barrels Dubbs cracking capacity. John L. Gray of Tulsa is president.

PREDICTIONS of early depletion of world supplies of petroleum have lost currency. "Fortune," the new business monthly whose initial article on petroleum contained, among other things about the subject, a history of the origin and growth of The Texas Company, assures its readers that there is plenty of oil. "Fortune's"

N TUNE

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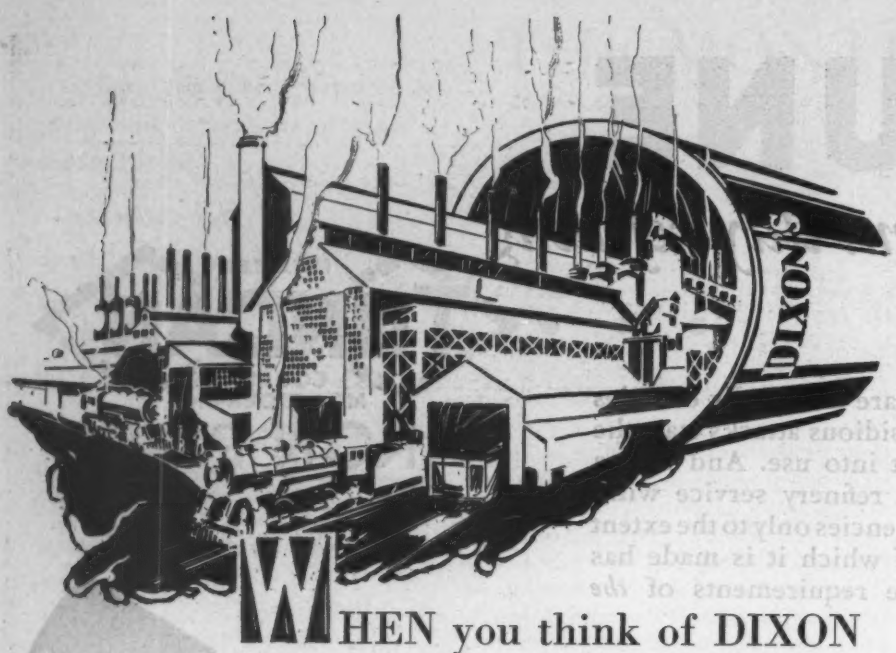

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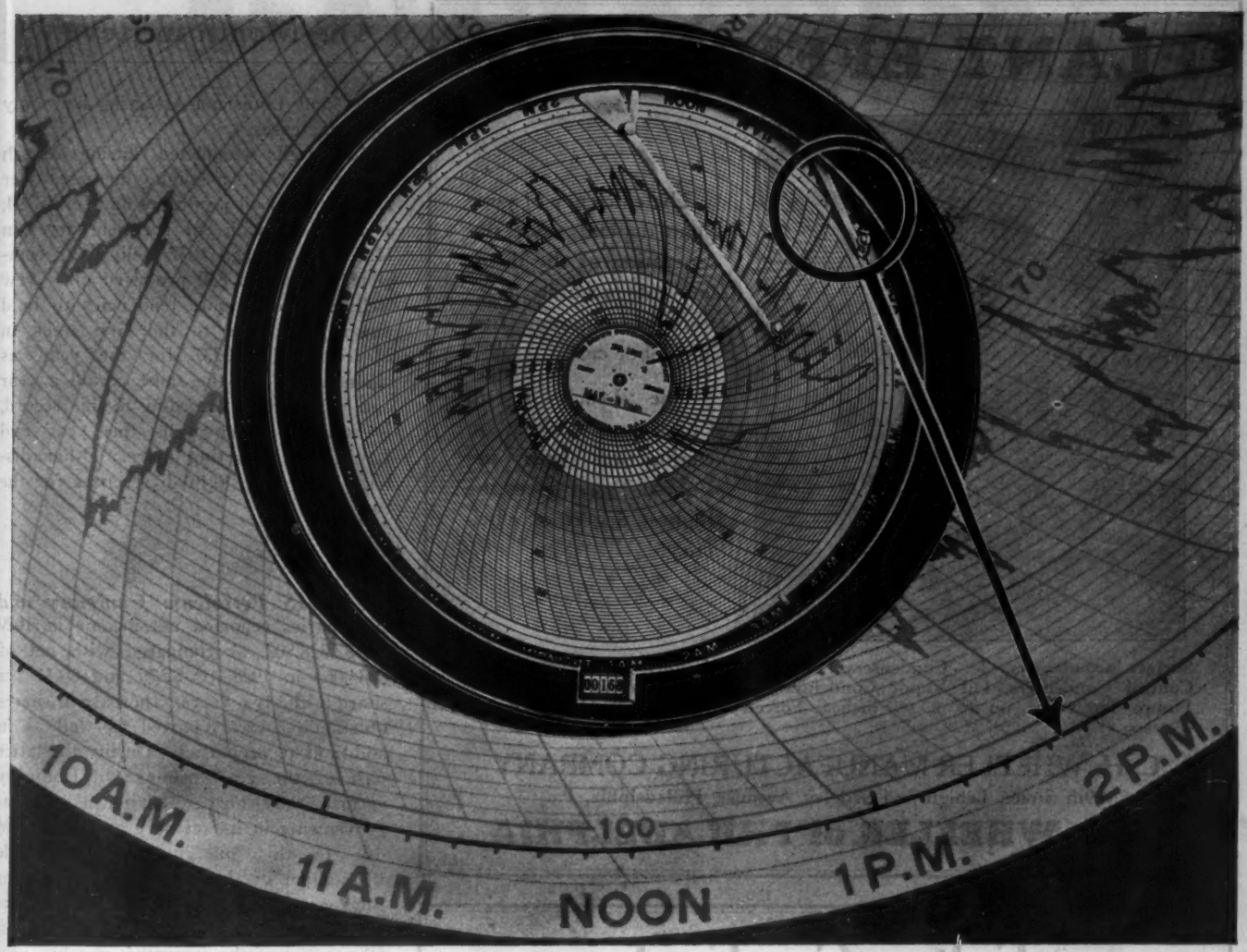
The Month in Review

writer on this subject did not qualify himself as an expert but his utterances nevertheless should carry some comfort to those of his readers who had any misgivings. More weight can be given to the opinion of Dr. Donald C. Barton of Houston, who told fellow geologists and geophysicists in assembly for the annual meeting of the American Association of Petroleum Geologists at New Orleans late in March that he has raised his estimate of the potential of the Texas and Louisiana coast region to 10,000,000,000 barrels. He was not challenged on the question, although the figure is more than three times what was once considered a big total. His hearers included the best geological talent, including those who are supposed to know their Gulf Coast. Geologist-prophets continuously are revising their estimates upward, but we must continue to give them credence on the basis that they are learning more.

DOMESTIC gasoline consumption in January, as revealed by tax figures, totaled 668,990,000 gallons, an increase of 9.6 per cent over the same month in 1929. Increase in the same area in January, 1929, over 1928, was 11.9 per cent, and the increase for the year 1929 was 13.2 per cent. The figures are a little mixed due to the fact that the tax data used is for those states having returns on monthly basis, while the year figure in on everything. Notably California consumption is not included in the January figures, nor are Illinois and New York in the comparison of months. It should be noted that the 11.9 per cent increase in January, 1929, over January, 1928, was, in gallons, 56,195,000, while the 9.6 per cent increase of 1930 amounts to 58,379,000 gallons. Which means that while the indicated consumption of the two months compared is lower in percentage, the total for January, 1930, is 2,184,000 gallons more than in the same area and period in 1929.

CRUDE oil production during March was 109,200 barrels daily below the average for February, the average for March being 2,542,950 barrels. This made gross production for the month 78,792,800 barrels. Of the reduction, approximately 97,000 barrels was in California, where a stringent curtailment program is in operation, assisted by enforcement in part of a state law requiring elimination of waste of gas in oil recovery. Oklahoma and that part of Texas included in the Mid-Continent producing area showed slight losses; Kansas, Gulf



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The Month in Review

Coast and Louisiana-Arkansas had only slight increases.

New wells completed during March numbered 1544, a slight increase over February, but oil producers numbered 794, as compared with 881 for February. In March a year ago 1677 wells were completed, of which 830 produced oil. New wells started, despite tendencies to hold down production, to the first week in March totaled 3737 for the year, as against 3792 for the same period a year ago. California, according to this record, is starting fewer wells this year and Louisiana is starting more. Other districts show but slight differences for the two years.

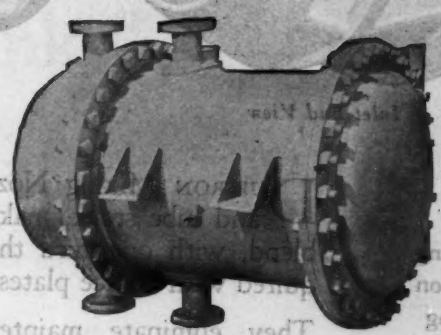
SIMMS Petroleum Company and subsidiaries reported net income in 1929 of $2,328,802, as compared with net of $334,064 in 1928, or $2.79 and $0.41 per share in the two years. Increase in shares outstanding was reported as well as in additions to properties. During the latter part of the year, Simms Oil Company spent $300,000 on new equipment and improvements in its refinery at Dallas, and due to this interruption total crude throughput of the company was less for the year, although the Smackover, Arkansas, plant was operated to capacity. About 60 per cent of the company's gasoline production was marketed through its own stations.

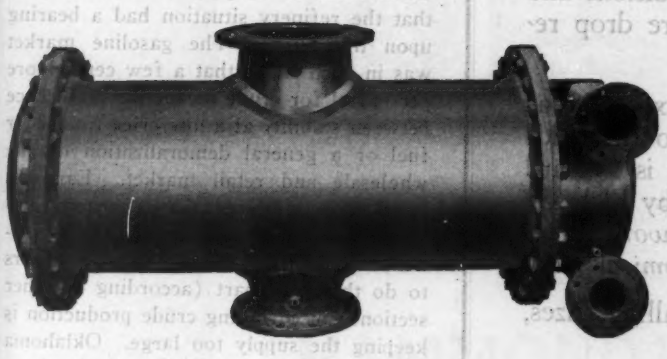
IMPORTS of crude and refined oil into the United States for the four weeks ended March 29 totaled 6,156,996 barrels, a daily average of 255,607. During the same period California shipments to the Eastern area averaged 66,321 barrels daily, or 1,856,988 barrels for the month. All of the California movement was refined gasoline, principally.

AMERICAN Petroleum Institute's compilation of refinery statistics for the week ending March 29 included reports from refineries representing rated capacity of 3,512,400 barrels, or 95.6 per cent of the estimated 3,675,900 barrels daily capacity of all plants in the United States. Runs to stills totaled 2,490,800 barrels daily, or 70.9 per cent of the rated capacity of plants reporting. Gasoline stocks were shown at 54,739,000 barrels, (indicating that supply of that commodity at all refineries is between 57,000,000 and 58,000,000 barrels). Reporting plants in California had 16,390,000 barrels of gaso-

REFINERY

HEAT EXCHANGE EQUIPMENT





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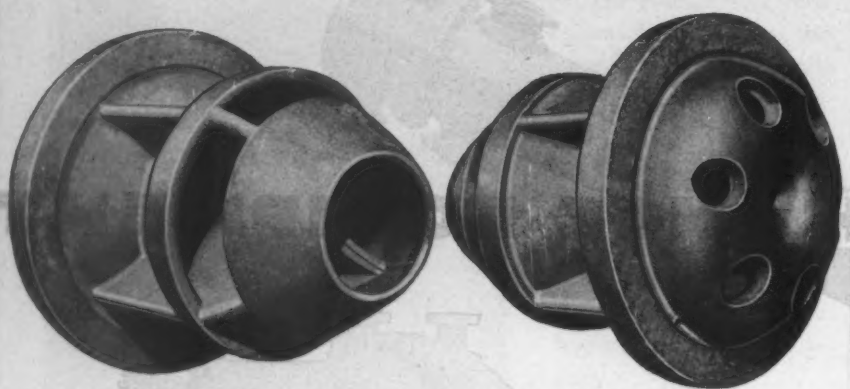

Inlet End View *Outlet End View*

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DURIRON Mixing Nozzles treat light oils and lube stock, make up emulsions and blend, with one-third the pressure drop required with orifice plates.

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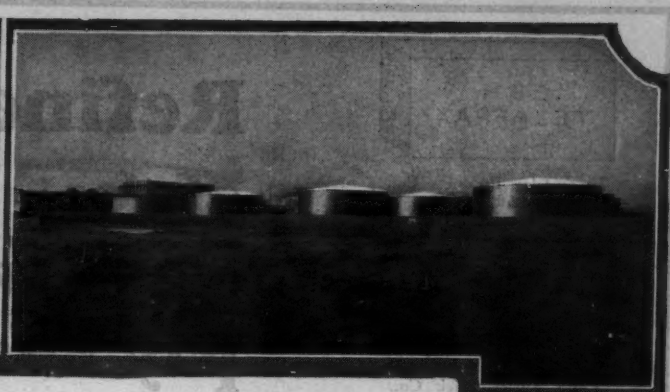
The Month in Review

line; on the Gulf Coast stocks were 9,283,000 barrels; East Coast 9,550,000 barrels; Indiana-Illinois-Kentucky 8,479,000 barrels. North Texas, Oklahoma, Kansas and the Shreveport area together had 6,123,000 barrels. The Rocky Mountain area had 3,049,000 barrels and Appalachian 1,865,000. Visualizing these figures superimposed over the refining map and with knowledge of who is who by districts, it is revealed that the superabundance of gasoline worrying the industry and the conservation board does exist—but it is in strong hands.

CRUDE prices were increased in California on March 11, the raise being from 1 to 25 cents per barrel, according to gravity. Increase came after substantial reductions in output and while ostensibly a reward to producers for helping the over-production situation by voluntary curtailment of output, it has been said that the refinery situation had a bearing upon the action. The gasoline market was in such shape that a few cents more per barrel for crude meant the difference between stability at a low price for motor fuel or a general demoralization of the wholesale and retail market. Early in April it is indicated that a general advance is due in the Mid-Continent section, although failure of Texas producers to do their full part (according to other sections) in curtailing crude production is keeping the supply too large. Oklahoma producers have curtailed with the hope and implied promise that if output is reduced prices will go up, and there are evidences of dissatisfaction over having that hope too long deferred.

NATURAL gas will be made available to every community in the Pacific Coast states under plans of Standard Oil Company of California. It is proposed that gas will be liquefied and shipped in tank cars to distributing plants in towns not reached by regular gas lines, there to be carbureted and distributed in the usual manner to domestic and industrial consumers. The distribution is to be through subsidiaries, one each in California, Oregon and Washington, of Public Service Company, the latter a subsidiary of Standard Oil Company of California.

The system of distribution differs from the individual unit such as used by Skelly Oil Company in its "Skellgas," in that the customer gets the supply through regular service pipes. The system supplies additional outlet for the gas reserves of the Kettleman Hills area, and because of the cheapness of the fuel initially and low cost of plants for the carburetion process,



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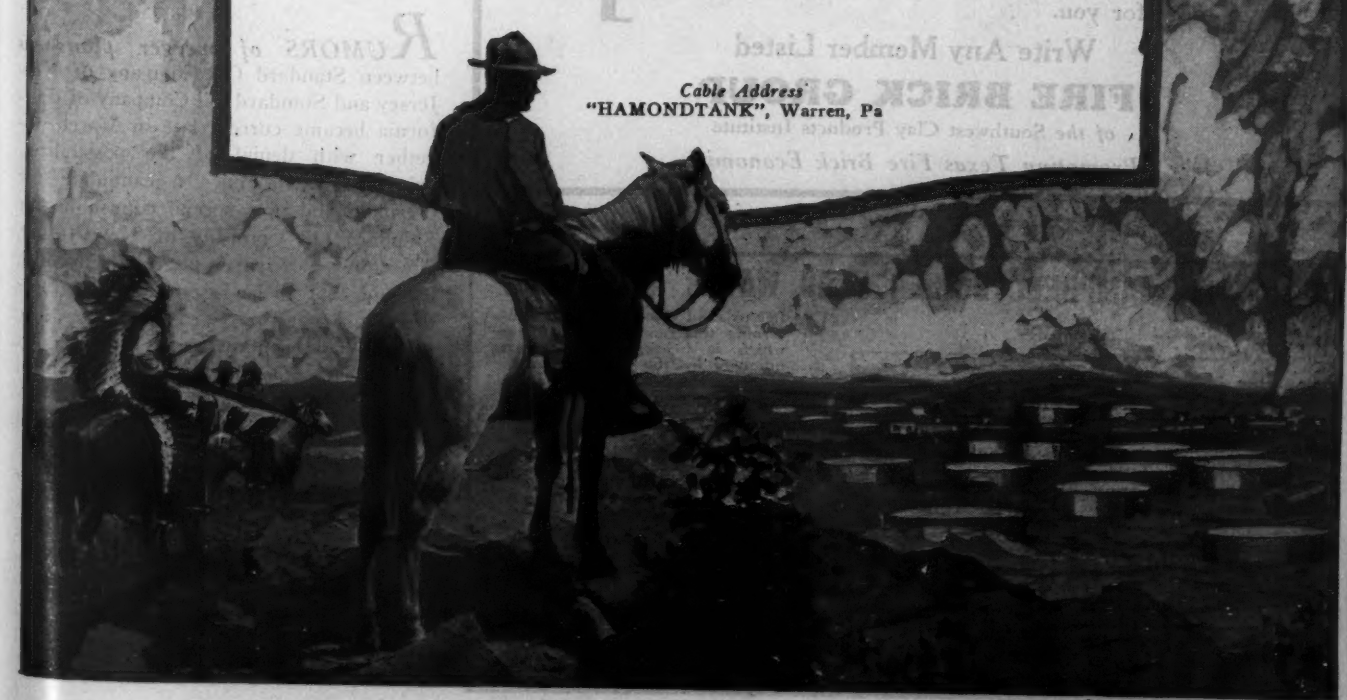

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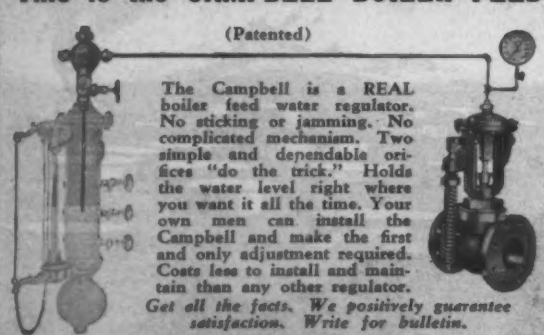

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The Month in Review

the convenience of gas service will be made available to communities where old methods made it prohibitive. Extension of gas service in California, supplying San Francisco and supplementing the supply for Los Angeles, has been rapid in recent months. Similar development has been going on in Texas, which means that sections which have heretofore been extensive users of fuel oil under industrial boilers because of advantage of location over coal, have switched to natural gas. Lessened use of oil fuel has had an effect upon mounting stocks that many people overlook in their consideration of the over-production problem.

THE American Petroleum Institute has asked operators of crude oil refineries throughout the United States to co-operate in filing weekly reports of their activities in order that a complete and accurate picture of the refining situation may be available. More than 95 per cent of the country's refining capacity already is represented in the reports made public weekly by the institute, and it is hoped that additional figures may be brought in. It is pointed out that particularly at this time, when business conditions generally, are being watched closely and especially since the Federal Oil Conservation Board has suggested that refineries advantageously could curtail their operations one-seventh, a complete picture of the refining situation would be unusually helpful. Refiners also have been asked to notify the institute of any changes in plant capacity, opening of new units, etc.

RUMORS of merger plans as between Standard Oil Company of New Jersey and Standard Oil Company of California became current late in March, together with denial of the possibility. John W. Davis, once a candidate for president and now special counsellor for Standard Oil Company of New Jersey, gave out a newspaper interview in which he said that there is no foundation for the report that a merger is in process. The subject had been discussed, he said, but the department of justice gave an opinion that it would violate the dissolution decree of 1911, which ended the matter. Had such a merger been carried through the resulting company would have been larger and its activity more widespread than was that of the original Standard prior to the dissolution. If the two companies have a good year in 1930 their combined production will approach the United States total in 1911, and their refinery capacity will probably surpass it.

A Gulf Publishing Company Publication

THE REFINER

and Natural Gasoline Manufacturer

Member Audit Bureau of Circulations

VOL. 9, No. 4 APRIL, 1930

GRADY TRIPLETT, *Editor* GEORGE REID, *Associate Editor*

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Chemical Treatment of Petroleum Distillates

By L. J. CATLIN
Chief Chemist, The Standard Oil Company, Kansas

IN attempting anything worthy of printer's ink on the subject of treating petroleum distillates, the writer feels that he has undertaken a large assignment: first, because of the breadth of the subject, and second, because of the swiftness with which methods may be changed and standards revised. Moreover, this is no attempt to offer anything new in the way of information resulting from research, nor an exhaustive review of the literature on the subject. The principal excuse for this effort is to attempt an angle of approach which has been more or less neglected in a great many treatises on this part of the laboratory work which has to do with control of treating plant operations. From a wide range of scientific publications the principal facts and theories have been compiled, which may serve as a basis for co-operation between the treating plant and laboratory, and which will show their relation to each type of control work. As a general backlog to these main objectives, it is hoped that the work will be useful to those who have a vocational interest in the subject, both from the ranks where contacts have been entirely of the practical sort, and those entering the industry from educational institutions where the point of view has been mostly, or entirely theoretical.

There is no thought of making chemists out of treating plant operators, although many of the chemical tests may be made by those not versed in chemical theory; neither is it an attempt to furnish instruction in all the details of operation which would enable a chemist to run a treating plant, for after all "each one in his place is best;" what is emphasized is that both are absoletely essential for best results, and the more each can understand what the other has to do the better they can work together toward a common end. Every car driver should read his instruction book enough to know the general features of carburetor, distributor, generator, etc., but it is not presumed that any amount of mere studying of this book will make him an expert mechanic; neither is it presumed that because a man knows all about a car that he can win a race on a speedway. It takes both types of genius to make a winning team. The best chemist is often poorest at routine, and the best plant operator is apt to be least interested in bookish theory and most exasperated by anything that calls for changing of operating schedules. The greatest obstacle to co-operative effort between laboratory and plant is sometimes the mere personal element of opposite attitudes. And perhaps above all else we need to remind ourselves of the old adage, that "a great deal more good can be done if we are not too careful about who gets the credit."

The division of labor designating who shall make certain tests is a matter of local expediency. Wherever possible there will be given first consideration to tests by which the operator may check up on the course of treatment. This is for the reason that most chemists have available reference-matter enabling them to choose between several methods of doing the same thing, while the operator does not have such advantages. However, the operator needs to understand that the scope of this work cannot hope to cover all possible variations of conditions affecting tests as outlined, and rely for final confirmation upon the laboratory.

PURPOSE OF TREATMENT

When Lindbergh flew from New York to Paris he

accomplished a great many things. He successfully carried out a hazardous undertaking, knocked out the barrier of distance between two continents, demonstrated the dependability of the airplane, and fired the imagination and enthusiasm of the world to the realization of a new epoch in the history of transportation. But none of these things was written into the specifications which formed the immediate incentive for the trip, which simply said, "make a non-stop flight from New York to Paris in an airplane and win a cash prize."

In the development of the petroleum industry, certain types of chemical treatment have come into use, which as time went on came to be carried out in a routine manner and resulted in a finished product which met the general demands of the buying public, but those carrying out the operations have seldom had a clear cut knowledge of either the exact requirements demanded in the finished product, or just what a particular part of the scheme of treatment contributed to any certain characteristic in the finished product. What a fine thing it would be if we knew just exactly what substances were desirable and what undesirable, and then knew a specific remedy for each particular case. This Utopian dream might not be practical, even if possible, but it is certain that we need more clearly defined specifications at various points along the line of treating operations, and a more definite knowledge of just what to expect from each step in the treatment. Such knowledge makes possible a more efficient utilization of chemicals and often saves both materials and time. Lack of this knowledge sets us out on a journey for a sort of indefinite port in a hap-hazard manner like a sail boat, covering a lot of unnecessary and fruitless territory, and eventually landing us some place which we hope will be as good as any other, but not knowing at any point along the way just where we will land nor exactly how we got there.

To follow up the analogy, there are four things we want to know:

First, where we are going—specifications on the finished product;

Second, where we start from—the nature of the raw materials;

Third, how we are going—type of treatment necessary;

Fourth, that which vitally concerns the operator, how to check up along the way to know if we are following the shortest possible course.

WHILE this series of articles has been prepared especially for the men who work at the treating plants it has its value for anyone connected with a refinery and particular value for those who have not had the advantage of a chemical education.

The author, L. J. Catlin, chief chemist of the Standard Oil Company (Kansas) has long held the conviction that chemistry can be made available to any man who is working with chemical processes. He has prepared this set of articles for the man of that classification.

It would seem that the material offers its highest value where the laboratory force takes it to the treating plant force by some systematic method. There are several instances of refinery chemists organizing classes among refinery workers. The material of this series will prove of great value for such methods. Where no such classes are available, chemists can find other means of placing the material in the hands of those who will benefit from it.

The series will continue over several months.

SPECIFICATIONS

At the outset it is at least interesting, and often quite helpful, to know where these originate. Are they promulgated by state law, buyer's specifications, or a standard of excellence set up by the manufacturer to be used as sales talk or margin of safety against outside inspections. One of the most constant laws of nature is the law of variation. We cannot produce two shipments of any product which are absolutely identical in all respects. We need to know the allowable limits of variation from a given standard and something of the seriousness of the situation if we do exceed that limit. In this connection it may be said that the limits of variation are always narrowing. Improved equipment and increasing knowledge of operations are making it possible. Other branches of the refining process have advanced farther along this line than the treating branch and give some indication of what may be expected in the future from this branch.

A very little observation of the use of specifications leads one to the conclusion that most of them originate in the laboratories of the manufacturer and often are adopted by outsiders with very little knowledge of what they mean, and are thereafter included in requirements upon other manufacturers on the general assumption that in some mysterious way they prevent him from "getting away with anything." A great many specifications coming to the laboratory of a refiner look like a compilation of all the tests the buyer has ever heard of, assembled without any thought of coherence or reason. It may be said, however, that this type of specification is becoming rare in the case of gasoline and kerosene, although not so rare in the case of the residue oils which have a wide diversity of uses. A very significant exception to the above statement of the origin of specifications is found in the case of anti-knock properties of motor fuels, coming from the laboratories of users rather than manufacturers, and no doubt indicative of

(*Continued on page* 128)

Automatic Control Insures Efficiency

By H. R. LINHOFF,
Manager Gas Department, Richfield Oil Company of California

WITH the development of the deeper producing sands in the Long Beach field during the past two years and the greatly increased production of natural gas, a number of new gasoline plants have been erected in this area. The companies already operating in the field have enlarged existing plants or installed new plants to handle the gas production from the lower stratum.

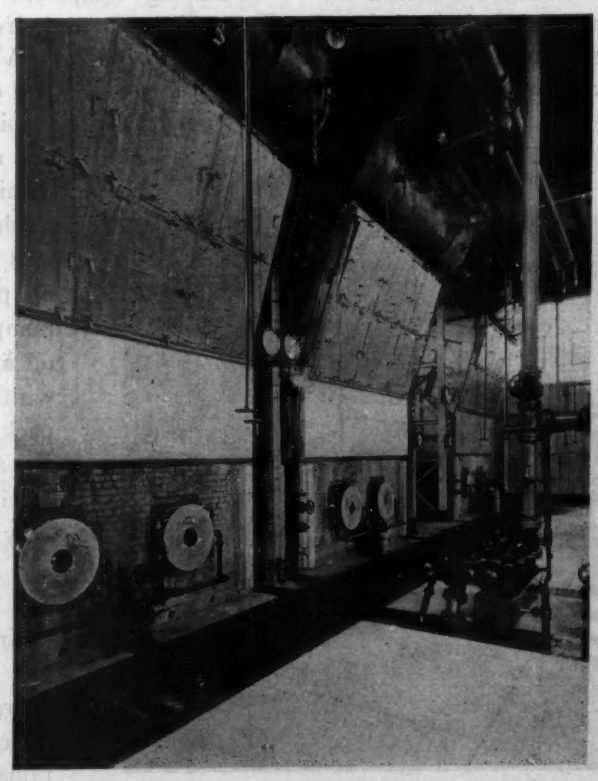
On January 2 of the past year Richfield Oil Company of California completed the construction of its Meador No. 9 natural gasoline plant, incorporating several features of interest in its design and operation. In July of the same year this plant was improved by the addition of a two-unit high pressure stabilizer, a boiler, additional cooling tower capacity and storage tanks. In compactness, efficiency and neatness of appearance this plant is one of the outstanding natural gasoline plant installations in the United States.

Preliminary to the erection of this plant the engineers of the producing and natural gasoline departments of the company made a careful study of the deep sand wells at Signal Hill, which indicated that natural rock pressure of these wells could be depended upon as a source of pressure for the operation of an absorption plant for a period of from six to nine months after completion. As a result of this investigation several wells are equipped with double gas trap installations in which 90 to 95 per cent of the gas is separated in the first trap under 50 to 75 pounds per square inch, and the crude oil, with some gas still held in solution, then taken to an elevated trap, where the remainder of the gas is separated at atmospheric pressure or slight vacuum. This low pressure gas is taken into the vacuum lines connected to plants possessing compression units.

The plant is so designed that after the period of flush production is over in the field, compression units may be added to augment the reduction in rock pressure due to natural decline. Gas from the field is scrubbed clean of entrained oil and foreign matter through a special horizontal line scrubber and then cooled in three A-240 single pass Griscom-Russell bent tube sections connected in parallel.

From the cooling sections the gas is taken to an accumulator scrubber of the centrifugal type where the water and condensate together with slight traces of crude oil mist are removed. The efficiency of the line scrubber is brought out by the fact that no crude oil has ever reached the accumulator scrubber during periods when crude oil was known to be entering the inlet scrubber.

The gas is handled by two 84-inch x 28-foot Campbell Oil-Froth absorbers. Each absorber has a maximum capacity of 12,000,000 cubic feet daily and will handle 500 gallons of absorption oil per minute at 30 pounds gauge pressure. Leaving the absorbers the gas is again scrubbed, a portion returned to the field for operation and development and the remainder compressed by a booster plant

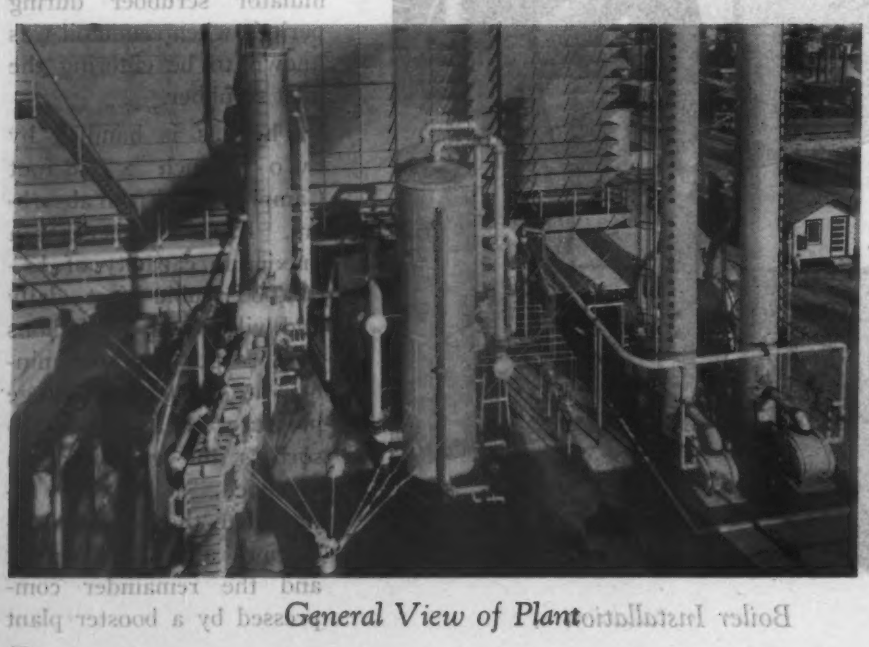


Boiler Installation

Stabilizer Pump House Showing Controls

and delivered to the Richfiled Oil Company's Watson refinery or sold to the Southern California Gas Company.

In the design of this plant care has been exercised in an effort to secure automatic regulation and all data necessary for efficient operation. Each absorber is equipped with orifice meters to measure the lean oil delivered to and the residue dry gas discharged from each tower. Through these means and suitable control valves the gas flow is set for each tower and the oil gas ratio adjusted accordingly.

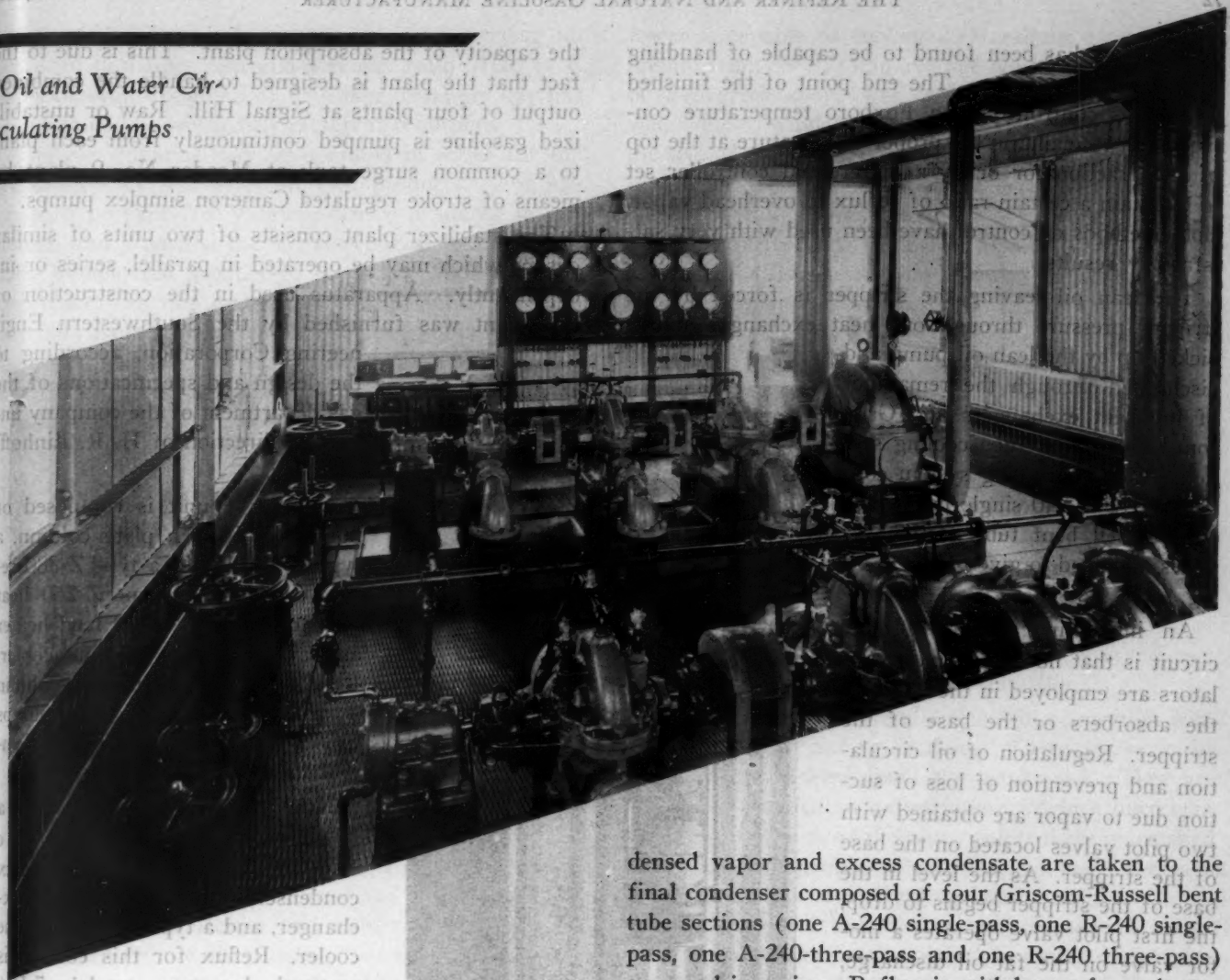


General View of Plant

Pumping equipment for the plant consists of two Terry-Cameron centrifugal pump units. Each unit is composed of a 6-NFV water pump, a 3HV lean oil pump and a 3NFV fat oil pump driven by a type G 133 horsepower Terry turbine. The two units are identical and may be started or stopped by the manipulation of one steam valve. Each unit has a capacity of 1800 gallons of water and 550 gallons of lean oil per minute. With this type of pumping unit a well balanced flow of oil and water is secured at all times with a minimum of maintenance and packing problems. The units have the advantage of compactness, wide flexibility and large capacity in a very small floor space.

DISTILLATION CIRCUIT

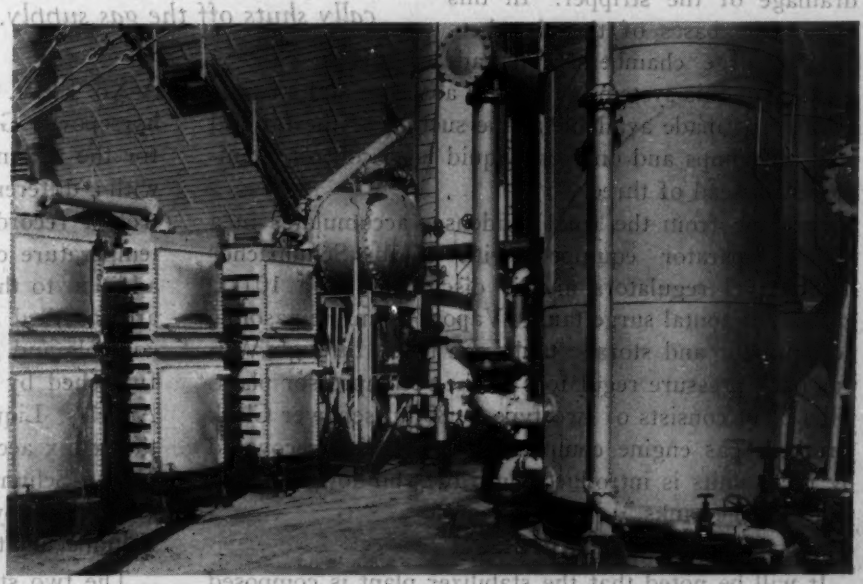
Enriched or fat oil is picked up at the base of the absorbers and charged into a 60-inch x 38-foot Ereco combination stripper and fractionator, through three type H-1250 heat exchangers in series and one



Oil and Water Circulating Pumps

type X-850 preheater furnished by the Southwestern Engineering Company. Live steam is metered to the stripper for agitation to secure proper stripping of the lean oil before leaving the stripper. The fractionator is somewhat different from former installations in that the reflux water separators are located on the ground level instead of high on the sides of the fractionator. Each separator is equipped with a Neilan-Schumacher liquid level regulator which discharges water as it accumulates.

Vapors from the fractionator are taken to the top of the water cooling tower, where they pass through a primary box-type condenser composed of four type H-144 Griscom-Russell bent tube sections in parallel. Although the entire volume of water circulated over the tower passes across these sections, they are so arranged that the flow of vapors may be adjusted to secure reflux at any desired temperature. Passing from the primary condenser the condensate and uncondensed vapor enter a reflux accumulator. The uncondensed vapor and excess condensate are taken to the final condenser composed of four Griscom-Russell bent tube sections (one A-240 single-pass, one R-240 single-pass, one A-240-three-pass and one R-240 three-pass) arranged in series. Reflux is withdrawn from the accumulator and dehydrated by means of a water separator located on the ground level. Reflux is discharged over the top of the fractionator by the difference in elevation between the reflux accumulator and the top of the fractionator. This distillation circuit is designed to handle a normal load of 30,000 gallons of gasoline



Distillation circuit and absorption towers

per day and has been found to be capable of handling 50,000 gallons per day. The end point of the finished product is controlled by a Foxboro temperature controller set to maintain the proper temperature at the top of the fractionator or by a differential controller set to maintain a certain ratio of reflux to overhead vapor. Both methods of control have been used with very satisfactory results.

The lean oil leaving the stripper is forced by the stripper pressure through one heat exchanger and is picked up by the lean oil pump and discharged through the remainder of the heat exchangers and Griscom-Russell bent tube cooling sections. The oil cooling system consists of 12 A-240 single pass Griscom-Russell bent tube sections in series arranged to give proper cooling.

An interesting feature of this circuit is that no liquid level regulators are employed in the bases of the absorbers or the base of the stripper. Regulation of oil circulation and prevention of loss of suction due to vapor are obtained with two pilot valves located on the base of the stripper. As the level in the base of the stripper begins to drop, the first pilot valve operates a motor valve on the fat oil discharge, causing the oil to enter the stripper more rapidly. If the level in the base of the stripper drops to a point where danger of vapor locking the first heat exchanger is encountered, the second pilot valve operates a motor valve on the lean oil discharge, thus preventing complete drainage of the stripper. In this circuit the bases of the absorbers act as surge chambers. The advantage of this system is that full absorber and stripper pressure is made available at the suction of the fat and lean oil pumps and only one liquid level control is employed instead of three.

Seven of these safety stations are located about the plant yard. Opening the quick-opening valve causes steam to extinguish the fire under the boilers and automatically shuts off the gas supply.

Gasoline from the final condenser accumulates in a water separator equipped with Neilan-Schumacher liquid level regulators and is discharged to a 10,000 gallon horizontal surge tank. Vapors from the gasoline accumulator and storage tanks are taken through Wilgus back pressure regulators to the recompressor plant. This plant consists of two type S, 80 horsepower Clark Brothers gas engine compressors. Gasoline recovered by these units is introduced into the run-down passing to the surge tanks.

STABILIZER

It will be noted that the stabilizer plant is composed of two units and appears rather large as compared to the capacity of the absorption plant. This is due to the fact that the plant is designed to handle the combined output of four plants at Signal Hill. Raw or unstabilized gasoline is pumped continuously from each plant to a common surge tank at Meader No. 9 plant by means of stroke regulated Cameron simplex pumps.

The stabilizer plant consists of two units of similar design which may be operated in parallel, series or independently. Apparatus used in the construction of this plant was furnished by the Southwestern Engineering Corporation, according to the design and specifications of the gas department of the company under the direction of H. R. Linhoff, manager.

Number 1 unit is composed of 36-inch x 50-inch plate column, a type X-160 kettle, a type Z-380 reflux condenser, a type Z-260 heat exchanger, a type S-40 feed heater and a type Z-170 gasoline cooler. Reflux is supplied to the column by model 6-H-5 Westco pumps driven by two 3-horsepower General Electric motors.

Number 2 unit is composed of a 36-inch x 30-inch plate, a type Y-440 kettle, a type Y-710 reflux condenser, a type Z-170 heat exchanger, and a type Y-140 gasoline cooler. Reflux for this column is pumped by two model 7-H-6 Westco pumps driven by two 5-horsepower General Electric motors.

Each column is provided with a 6-inch x 3-inch x 6-inch Oillack Gardner-Denver steam duplex pump for charging. Water is supplied by a No. 4 N.F.V. Cameron centrifugal pump driven by a 35-horsepower type E Terry turbine. A No. 4 L.V. Cameron centrifugal pump driven by a 30-horsepower General Electric motor is used as a standby for the turbine unit. Each stabilizing unit is equipped with a differential feed control, a differential reflux control, a recording pressure control, a recording kettle temperature control and a recording thermometer. In addition to these instruments indicating pressure gages are installed at various points on the circuit. These controls and gages are of the Foxboro type and were furnished by the Jensen Instrument Company of Los Angeles. Liquid levels in the bases of the columns and the reflux accumulators are maintained by four No. 95 Neilan-Schumacher liquid level regulators. All motor valves employed in the plant are also of the Neilan-Schumacher type.

The two stabilizing units have a combined rated capacity of 75,000 gallons per day when operated at a

pressure of 250 pounds per square inch, carrying an overhead of 10 per cent and a reflux ratio of 10 to 1. A maximum throughput of 150,000 gallons per day has been attained under slightly different conditions.

The two columns may be operated in series for the preparation or separation of two products. For example, a propane-free gasoline can be produced in one column and a portion thereof re-rectified to a substantially butane-free product in the other column at the same time. In this manner an ideal aviation gasoline may be manufactured to meet United States Navy fighting grade specifications. One column may also be used to prepare pure propane by introducing excess reflux from the first column as feed to the second column.

COOLING TOWERS

The cooling tower employed in this plant is a 22 section "KKC-3" atmospheric Fluor cooling tower, employing several unusual features. As previously stated the primary box-type condenser is located on the top of the tower. Condensation in this piece of apparatus is secured by passing the entire volume of water, circulated over the tower, across and counter current to the stream of vapors. Water leaving the weirs of the condenser box passes through a common flume to three cross distributing troughs which feed the water to three lateral distributing troughs. Another feature of interest in this tower is the redistribution system. The water is collected half way down the tower and redistributed by means of cross collectors and redistribution troughs. This feature reduces the windage loss and increases the efficiency of the tower through uniform deck loading.

The Griscom-Russell bent tube sections employed to cool the gas and oil, and to condense the gasoline and recompressor vapors are all mounted in the "C" or coil section of the tower and manifolded for ease of control and accessibility. A collection and redistribution system is used to collect and redistribute the water over the Griscom-Russell bent tube sections. Each bay of the tower is equipped with easily operated gates to control the volume of water delivered to cooling sections.

Under normal conditions with a five-mile wind this tower is capable of cooling 2600 gallons of water per minute from 88°F. to an average temperature of 70°F., or 5 degrees above wet bulb temperature. Loss of water due to windage is reduced to a minimum through the use of adjustable spray deflectors mounted on the lee side of the tower between the decks.

The overall dimensions of this tower are 28 feet wide by 139 feet long by 55 feet high. It is constructed of select California redwood lumber, brass bolts and copper nails, and so designed that no guy wires are necessary.

BOILER PLANT

The boiler plant consists of three 300-horsepower, 200 pound pressure, water tube, Marine-type Foster boilers. Thep are equipped with a Wilgus automatic gas regulator, Enco burners and Republic draft gages. A Graver green sand water softener, Cochrane feed water heater, Worthington simplex feed pump and a Wilgus boiler feed governor insured a steady and uniform supply of hot water to the boilers.

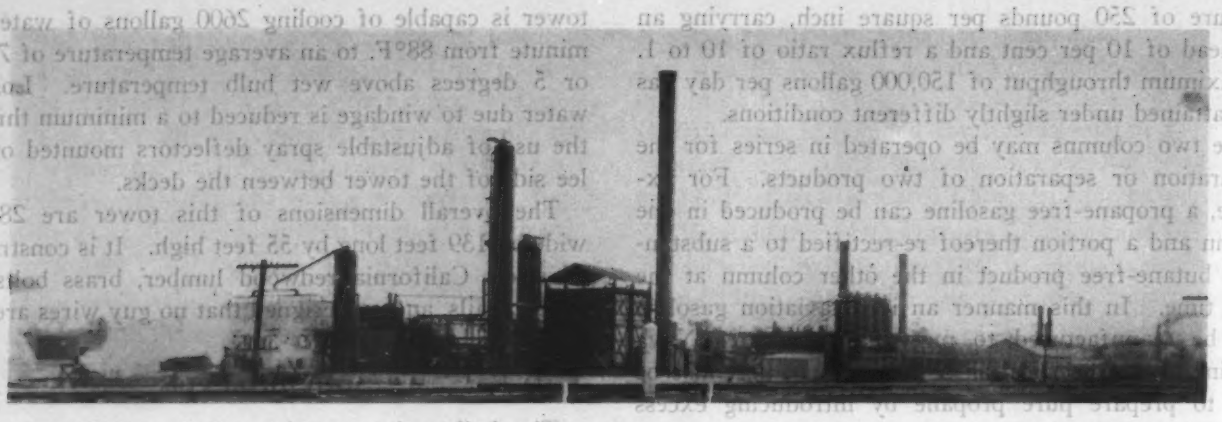
SAFETY PRECAUTIONS

Another item of interest is found in connection with what is termed "Safety Stations." There are seven of these stations located about the plant yard. They are designated by small red electric lamps which burn continuously. At each of the seven points there is installed a small quick opening valve on a gas line. At each point there is also a fire extinguisher.

In the event of a fire or a serious gasoline, oil or gas leak anywhere in the plant, the operators are instructed to run to the nearest red lamp and open the quick opening valve. This permits the gas pressure to operate two motor valves at the boiler plant. One valve stops the flow of gas to the burners under the boilers and the other introduces a flow of steam into the fire box of each boiler. In the event of a gasoline, oil or gas leak within the plant, this system affords an immediate means of prevention of a flash from the boiler plant. This means of fire prevention is particularly valuable for gasoline plants built in congested areas.

This plant was erected by the construction department of the Fluor Corporation, Limited.

The Natural Gasoline Association of America will hold its annual meeting in Tulsa May 20, 21, 22. The May issue of The Refiner and Natural Gasoline Manufacturer will pay particular attention to subjects of interest to gasoline plant operators.



Dixie Oil Company Refinery, Superior, Louisiana

Louisiana-Arkansas Refineries Operating 60 Per Cent

AS a group, the refiners in the North Louisiana-Arkansas refining district have confined their efforts to repair work and remodeling of equipment during the past year rather than experiencing a concerted enlargement of capacity through the installation of new refining facilities. However, in this area there have been a few installations of high pressure equipment to effect an increase in the cracking capacity of the district.

During the month of March, at which time all of the operating plants in the district were visited, it was found that the 16 refineries operating in North Louisiana and Arkansas, with a total rated capacity of 99,530 barrels daily, were processing crude at the average rate of 61,250 barrels daily, or at 61.5 per cent of the reported plant capacity. This is in line with the recent suggestion of the Federal Oil Conservation Board's suggestion that refiners adopt a six-day week, or its equivalent, in order to curtail production of gasoline.

In the Shreveport district, Louisiana Oil Refining Corporation is operating at about 14,000 barrels through-put daily, processing crude at its Gas Center plant and cracking its gas oils and residues at the Bosier City plant. During the past year this company has improved its cracking department efficiencies through the adoption of certain practices in heat exchanger arrangement and recycling methods. This work was discussed by B. P. Crittenden, vice-president of the company in a paper before the recent convention of the Western Petroleum Refiners Association, at Shreveport. It is reported that the company contemplates the installation of new tube type pressure equipment during the year. The company recently enlarged its light oil chemical treating plant through the installation of five new treating and settling drums and auxiliary equipment.

Crystal Oil Refining Corporation at its 10,000-barrel plant is operating about half capacity while subjecting the equipment to its spring cleaning. The Jenkins cracking department has been recently reconditioned, and two new continuous chemical treating plants have been installed. Other Shreveport plants, such as The Texas Company, at Ardis, which is operating intermittantly, and the small Dartois Refinery, also operating but short periods, while Shreveport Eldorado Pipe Line Company, with its plant located at Jewella, is operating at about 90 per cent capacity with half of its cracking department inoperative. At Jewella, Reserve Natural Gas Company (Cities Service) has placed its 2000-gallon absorption gasoline plant in operation.

North of Shreveport at Hosston, the Bayou State Refining Company, which practically owns the Hosston crude producing area, has been operating its pipe still vacuum skimming unit in connection with its shell still installation of the Schultz vacuum system, for the production of nearly 50 per cent lubricating oils from its daily crude production of 750 barrels. The Hosston crude yields lubricating oils of high flash and fire, high viscosity, and with cold tests ranging as low as 40°F. below zero. The plant was completed about a year ago.

At Superior, the Dixie Oil Company (Standard Oil Co., Indiana) is operating its 3000 barrel skimming plant of continuous shell still battery and bubble

(*Continued on page* 112)

SECOND ARTICLE

Absorption and Absorption Oils

By I. N. BEALL
Chemical Engineer

IN common parlance, the ratio of oil to gas is referred to as gallons per 1000 cubic feet. The laws governing the phenomenon of absorption are upon a different basis than this; therefore if it is still wished to retain the old terminology for oil-gas ratio it will be necessary to give it a significance based upon a more fundamental conception.

THE MOL-POUND OIL-GAS RATIO

Comparative estimates are made on a weight basis. Walker Lewis and McAdams in their "Principles of Chemical Engineering," use the term "mol-pound" to designate the molecular weight in pounds. For convenience of comparison, and as an easier basis of figuring costs, the writer has used the term "mol-gallon."

In order to obtain the mol-gallon for a pure hydrocarbon it is simply necessary to divide the pounds per gallon into the molecular weight. The molecular weight of an absorption oil can be approximated by using the average boiling point from the distillation curve and the gravity. For the reader's convenience "Table 1" gives the values for a few selected hydrocarbons.

By Raoult's law the vapor pressure of a given mixture of solute and solvent is determined by adding the vapor pressures and dividing by the total relative number of mols. Thus 50 mols of oil of four millimeters vapor pressure admixed with 50 mols of butane of 1600 millimeters vapor pressure would have a combined vapor pressure of 802 millimeters absolute. To convert millimeters of mercury to pounds absolute divide by 51.7. To convert to pounds gauge subtract 760 and divide by 51.7.

There is a marked difference in the absorptive capacities of oils on a gallonage basis. This difference is in greater part explained by the number of gallons per mol and the vapor pressure. Other deviations have to do with the chemical nature of the oil, but as knowledge along this line is as yet extremely meagre, no general laws will apply. This need not, however, occasion any particular worry as all oils are sufficiently related chemically to cause but small variations from this source. The two, and by far the most important, characteristics of an oil from the physical viewpoint of absorptive capacity for a gas are molecular weight and vapor pressure.

TESTS FOR ABSORPTIVE CAPACITY OF OILS

The real test of an absorption oil is its efficiency in plant operation. Obviously it is impractical to depend upon such a wholesale method of test, therefore less expensive methods are advisable.

A vapor pressure curve can be constructed for the oil from the lowest absorption temperature to the highest temperature used in fractionation, thus serving two purposes. It may be necessary to replace the manometer with a pressure gage reading in pounds per square inch for the higher temperatures.

For purposes of comparing the absorptive capacity of one oil with another a mixture of 10 parts by volume of a standard gasoline from the plant may be added to 90 parts by volume of the oil and a vapor pressure curve constructed. This too can be made to cover the full range of absorption and fractionation conditions. Some skill and a low temperature will be required while making the test to avoid undue loss by evaporation. The oil having the lowest vapor pressure for a given absorption temperature is the oil having the greatest absorptive capacity.

It may be well to mention at this point that a satisfactory method for determining vapor pressure in the laboratory consists in the use of a pressure bomb equipped with a manometer reading pressure in millimeters of mercury. This procedure will be found sufficiently accurate for general purposes.

If a standard sample of gasoline is kept under pressure for this purpose at all times, the plant oil may be tested when desired for signs of deterioration in absorptive efficiency. Thus a set of curves over a period of time gives comparative results for absorptive conditions in the plant.

Another method of test is to use a measured volume of a standard gas against a measured volume of oil at some standard temperature. Agitate the two together and take a reading of gas volume when contraction

Absorption and Absorption Oils

IT is difficult to attempt to cover so broad a subject in one article. If a full exposition were made of all the elements and natural laws that might be grouped under this heading, with the attendant calculations and formulae involved, a volume, no doubt, would be quired.

I. N. BEALL

It is only since the advent to the industry of the bubble type absorber and the bubble type fractionating column that much interest has been evinced in a treatment of the subject on a quantitative, fundamental basis.

Theoretical formulae applicable to the subject have been available for a number of years. There is a revival of interest and an awakening within the industry to the fact that an application of the natural physical laws results in higher yields and greater profits. There is much yet to be done both in the perfection and application of old laws and the development of new principles and formulae.

This article will serve to give a clearer insight into this interesting subject. Mr. Beall will follow this writing with Part Two, dealing with the same subject, in the near future.

ceases. This method is not as satisfactory as the pressure bomb procedure described above.

SELECTION OF AN ABSORPTION MEDIUM

The ideal absorption medium would be a pure hydrocarbon having a negligible vapor pressure at absorption temperature with the smallest number of gallons per mol pound. In addition, the boiling point of this ideal hydrocarbon should be sufficiently higher than the boiling point of the heaviest or least volatile hydrocarbon consistent of the gas, so that it will be possible to effect clean separation of absorbed from absorbent by the process of fractionation. The more efficient the fractionation, the closer the boiling points may be. For a good fractionating column 25°F. will be found sufficient; a differential of 50°F. should be ample for average conditions.

Inasmuch as pure hydrocarbons are, as a rule, impossible to obtain at a reasonable cost, the alternative is to select some cheaper absorbent medium. The writer has tested a large number of commercial absorption oils and the following conclusions may prove of practical interest.

The most efficient oil tested was made from an end-point cut on a treated gasoline prepared from a Smackover crude. This crude was cracked by the Dubbs Process. The oil had a Baume of 32.5°F. with an initial boiling point of 402°F. and an end-point of 484°F. by Engler distillation. The distillation and gravity indicate the possibility of constituents of the aromatic series. It might be advisable here to mention also that this oil met the usual color, corrosion, doctor emulsion and chemical unsaturation tests. The wearing qualities of the oil were good and it was highly resistant to deterioration by heat and oxidation.

Better light absorption oils can be produced commercially than are now available. There is urgent need for new specifications for light absorption oils suitable for the modern natural gasoline plant. As a practical illustration, three oils were compared on the basis of absorptive capacity. These were as follows:

1. A high distillation mineral seal oil of 36.5°F. Baume.
2. A used plant oil.
3. The low distillation, short range, low Beaume oil previously described.

Oil No. 3 had approximately 50 per cent higher absorptive capacity than No. 1 and 90 per cent higher than the plant oil. What this means in equivalents of pressure and cooling will be discussed later.

Deterioration in plant oil is chiefly due to oxidation and pyrogenesis; the two work together producing sludge and gum, lengthening the distillation range and with a resultant darkening in color. The resistance of an oil to oxidation and heat may be determined by heating several times to 400°F. in a pressure bomb under 25 pounds initial air pressure. Changes in gravity, distillation, residue and color indicate the degree of deterioration. Chemically unsaturated oils show the greatest deterioration; paraffin base oils come next. Those from naphthene base are superior to both of the above while the aromatic base oils (cracked oils), when treated with acid followed by caustic and steam distillation, are the most resistant as shown by test and actual operating conditions.

REDUCTION OF NATURAL GAS TO A MOL BASIS

At the same temperature and pressure equal volumes of all gases contain the same number of molecules, or aggregates of molecules. This is an extremely important generalization. If molecular weight be expressed in pounds (mol-pounds or mols) the volume occupied at 32°F. and atmospheric pressure is equal to 359 cubic feet. For natural gas on a four-ounce basis and at 60°F. this volume becomes 373 cubic feet according to the gas laws for temperature and pressure. Thus it becomes possible to compute the average molecular weight for a given gas by calculating the weight per 1000 cubic feet. In order to do this, multiply the weight of one mol of air, 28.94 (specific gravity of air = 1.00) by the specific gravity of the gas.

An example of how well this checks theory is obtained by multiplying the constant for air by the specific gravity of methane (mol. wt. equals 16.03). The specific gravity of methane is 0.554 so $28.94 \times 0.554 = 16.033$.

A gas of 0.80 gravity would have an average molecular weight of $28.94 \times 0.80 = 23.2$.

CALCULATIONS BASED ON MOL RATIOS OF OIL TO GAS

Let us suppose for example that this gas has been reduced to 80 per cent of its original volume and the sp. gr. reduced to 0.65. What would be the average molecular weight of the portion absorbed?

$28.94 \times 0.80 \times 0.65 = 15.05$ pounds.

$$28.94 \times 15.05 = 3.89 \text{ pounds} = \frac{2}{10} = 0.2 \text{ mol}$$

1 mol = $13.89 \times 5 = 69.45$.

This would give an average molecular weight almost that of pentane which is 72.10.

The specific gravity of the absorbed gas would be:

$$\frac{28.94}{69.45} = 2.4$$

Such a figure would indicate poor absorption efficiency. The factor for conversion of molecular volume to 1000 cubic feet is 2.68.

$2.68 \times 15.05 = 40.334$ pounds absorbed

At the average of 5.2 pounds per gallon, which would correspond to such an average molecular weight, this would amount to approximately eight gallons per 1000 which would be an unusually high gallonage for an absorption plant.

Further, for illustration take an arbitrary example of an oil circulation of 50 gallons per 1000 cubic feet of gas. The molecular weight of the oil is 170 and the Beaume gravity is 36.0°F. An oil of this gravity will weigh 7.022 pounds per gallon, therefore: $\frac{170}{7.022} = 24$ gallons per mol, or in other words, the mol gallon equals 24. The mols of oil per 1000 cubic feet would be:

$$\frac{50}{24} = 2.08.$$

As 200 cubic feet of gas was absorbed per 1000, and as the mol of gas equals 373 cubic feet, the fraction of a mol in the oil would be: $\frac{200}{373} = 0.54$.

The total mols of absorbed and absorbent amount to 2.62 and the respective mol per cents, 20.6 and 79.4. Assuming the vapor pressure of the oil to be four millimeters at a certain temperature, and the vapor pressure of the mixture to be 20.6 pounds per square inch at this temperature, what would be the vapor pressure of the absorbed material when separated from the oil?

For all practical calculations the vapor pressure of the oil may be disregarded. The absolute pressure would be 100 pounds per square inch or $100 - 14.7 = 85.3$ pounds gauge. This would be the pressure required for total condensation.

The volumetric per cent saturation in the foregoing example would be:

$$\frac{8 \times 100}{(50 + 8)} = 13.9 \text{ per cent absorbed or solute}$$

$$\frac{(50 + 8)}{50 \times 100} = 86.1 \text{ per cent of oil}$$

Had the molecular weight of the oil been 240, the vapor pressure remaining the same, 50 per cent more gallons would have been required for the same mole per cent, with a consequent lowering of the volumetric saturation to 9.9 per cent.

$$\frac{8 \times 100}{(75 + 8)} = 9.9.$$

The higher the volumetric saturation the easier it will be to separate. The relationship between problems of absorption and fractionation is immediately evident.

Provided an ultimate gas analysis is available, the probable percentage absorption of each constituent can be calculated with a reasonable degree of accuracy for

a given temperature and pressure. For such calculations it is necessary to know the mols of oil per mol of constituent of the gas, the vapor pressure of the oil and the vapor pressure of the constituent at absorption temperature and the efficiency factor or characteristic of the apparatus.

The vapor pressure of the oil expressed in millimeters plus the vapor pressure of the constituent in millimeters multiplied by the mol fraction of constituent equals the the vapor pressure of the mixture. If X equals mol fraction and p_o and p_s are the respective vapor pressures of solute and solvent, the vapor pressure of the mixture is P equals $(p_o + p_s)$ X. As an example, the vapor pressure of an absorption oil is four millimeters and the vapor pressure of Butane is 1600. The mol fraction of Butane in the mixture is .1 or 10 mol per cent of Butane to 90 mol per cent of oil. What will be the vapor pressure of the mixture? The calculation is P = (1600 + 4) x .1 x 160.4 millimeters. By the law of partial pressures which states that each gas in a mixture of gases exerts its own vapor pressure as if it were alone, and that the relative volumes are as the relative partial pressures, what part by volume would be butane in a mixture of inert gas in equilibrium with the butane-oil mixture at 100 pounds absolute pressure? Converting pounds absolute to millimeters 100 x 51.7 = 5170. Let X equal unknown volume of butane in mixture and V equal total volume of gas mixture = 100 per cent, p equals partial pressure due to butane in oil mixture and P_a equals absolute pressure, the equation becomes

$$X = \frac{Pb}{P_a} \text{ or } X = \frac{P_b \times V}{P_a} = \frac{160 \times 1}{5170} = 3.1 \text{ per cent.}$$

An increase in oil will cause a corresponding decrease in the butane percentage left in the gas, the same holds true in regard to the absolute pressure. Lowering the temperature lowers the vapor pressure, thus reducing the percentage of butane left in the exit gas. For natural gasoline plant operation, absorption is estimated on a butane basis, the lower partial pressure constituents being absorbed to a relatively greater extent. The same mol per cent of Pentane in the gas in foregoing example would have been reduced as follows: (430 millimeters equals vapor pressure of pure pentane at 70°F.)

$$\frac{430 \times .1 \times 100}{5170} = 0.84 \text{ per cent.}$$

There are additional refinements to this method of calculation, but for purposes of illustration the above is sufficient and correct enough to use for practical conditions. The real check on absorption efficiency is by analysis of inlet and exit gas by fractional separation. With the information at hand, the operator can increase his pressure, lower temperature, increase oil rate, or change oil using the approximate formula given as a guide.

THE ECONOMY OF EFFICIENT ABSORBER AND ABSORPTION OILS

As the efficiency of absorption is dependent, among other things, upon the amount and quality of oil circulated, oil circulation may, if reduced to the mol-gallon basis, be expressed in equivalents of pressure and cooling. For an estimate of relative costs required to raise the pressure equivalent to that of doubling the oil circulation, or of changing the oil for one of twice the absorptive capacity per gallon, it is only necessary to figure the relative H.P. requirements for twice the absolute pressure. A similar relationship holds for comparison between two absorbers of different efficiencies. Obviously double the mols of oil would be required for one having an 80 per cent efficiency, or in terms of compression, twice the absolute pressure would be required. The absorber might well be thought of as the heart of the system and the absorption oil as the life fluid, for any defect in either shows up in a variety of systemic disorders throughout the entire process of manufacture.

VISUALIZATION OF ABSORPTION

Absorption can be best visualized in terms of surface. The rate at which a given gas or vapor will be absorbed by a volume of oil is dependent on the total area exposed within a certain period of time. Assuming the molecular theory of matter to be correct, the maximum possible absorption would be where each and every molecule of oil was exposed to each and every molecule of gas or vapor. Such a condition would be realized if both gas and absorbent were in vapor phase and then instantaneously cooled to effect condensation. Such a procedure would effect immediate equilibrium between the liquid and gas phases.

Another method of obtaining equilibrium between oil and gas would be to confine the two within a container and let sufficient time elapse. The greater the area or surface of oil exposed to the gas, the less the time necessary to attain equilibrium. Agitation would increase the area exposed within a given time and thus increase the rate of diffusion of the gas into the oil.

ABSORBER DESIGN

The bubble tray absorber is the most efficient practical means for effecting absorption. The liquid volume of a bubble is very small as compared to the surface, whereas in the drop the reverse is true. In the old style packed or baffled columns the trend was toward providing more surface for the oil to form films, the greater the amount of surface exposed per given length and area, the more efficient the column. The mechanical absorber sought to effect greater contact (more oil surface) by moving the absorbent at high velocity to increase the film and provide a spray. One advantage in both packed and mechanical types was the low pressure drop between gas inlet and outlet. The disadvantages are apparent. In a bubble tray absorber the distribution of gas in contact with oil determines the efficiency of absorption per plate. The problem is how to get the gas in contact with the greatest amount of oil surface in the shortest period of time. Here again it is going to be necessary to visualize by some simple means.

If a sphere be divided into a number of smaller equal spheres, the sum area of the surfaces of the smaller

spheres is to the surface of the original sphere as the cube root of the number of divisions is to 1. Thus 125 small spheres with a volume of one would have the $\sqrt[3]{125}$ equals five times the surface of one sphere with a volume equal 125. The point here in its application to absorber design is that it is better to depend upon a great number of small bubbles to effect surface contact between oil and gas than it is to depend upon a smaller number of larger bubbles. As the number of bubbles of gas is dependent upon the number and size of openings or avenues of escape into and through the oil, a relationship is immediately established between the number of caps per plate and the number of serrations or other avenues of escape per cap. Thus theoretically an increase of 125 times the number of avenues of escape for the gas into the oil per plate would increase the efficiency five times, provided the size of the bubble is in direct ratio to the size of the opening and the oil-gas ratios remain the same.

The depth of cap submersion is also a frequent matter of controversy. The arguments in favor of deep submersion are that the bubble is in contact with the oil for a greater length of time than in shallow submersion, and that greater agitation effects are produced. The benefits are more apparent than real as the rolling and welling effect of the oil has a tendency to produce unequal liquid level conditions with a consequent unequal distribution from the caps. There is this also to consider: only the inner surface of the bubble is exposed to gas until it rises above the surface and then both inner and outer surfaces are exposed until the burst occurs.

Shallow submersion cuts down the pressure drop per plate and does not produce as great rolling and welling effects which results in more even distribution. As the same volume of fresh oil is in the same ratio to the gas regardless of depth on the plates only sufficient depth should be maintained to provide a liquid seal.

Other factors in absorber design have to do with practical operating condition. Distance between plates is immaterial to absorption efficiency per plate in so far as it provides sufficient height for the major part of the oil spray and entrainment to separate before reaching the next plate. A distance of 18 inches is usually sufficient, although no harm could result from making this distance greater.

Overflows should be ample to provide for maximum oil capacity and the underflow space sufficient to allow small friction drop. Depth of liquid seal is determined from the pressure drop per plate at maximum capacity. Other accessories have to do with mist extraction, liquid level control, and temperature and pressure regulation. At this point it would de well to add that too much attention cannot be given to the selection of the correct absorption equipment and its installation. Plates should be level, the inner bell of the cap smooth and well rounded and the size, construction and submersion uniform.

TABLE NO. 1

Name—	Baume Gr.	Sp. Gr. Liq.	Formula	B.P. °F.	Mol. W.	Lbs. Gal.	Gal. Mol.	
Paraffin								
Methane	....	....	CH_4	—265	16.03	....	....	
Ethane	194.0	0.432	C_2H_6	—135.4	30.05	3.601	8.345	
Propane	142.0	0.525	C_3H_8	—49.0	44.07	4.376	10.070	
Butane	109.0	0.585	C_4H_{10}	+34.0	58.08	4.876	11.911	Natural Gas
Pentane	92.2	0.630	C_5H_{12}	97.8	72.10	5.251	13.730	Hydrocarbon
Hexane	78.9	0.670	C_6H_{14}	156.0	86.12	5.585	15.420	
Heptane	70.9	0.697	C_7H_{16}	208.8	100.13	5.810	17.234	
Octane	65.0	0.718	C_8H_{18}	258.0	114.15	5.985	19.073	
Nonane	59.2	0.740	C_9H_{20}	302.0	128.16	6.168	20.777	
Decane	56.7	0.750	$C_{10}H_{22}$	343.0	142.18	6.252	22.743	
Undecane	54.2	0.760	$C_{11}H_{24}$	383.0	156.20	6.335	24.657	
Dodecane	51.8	0.770	$C_{12}H_{26}$	417.0	170.22	6.418	26.521	
Tridecane	46.8	0.792	$C_{13}H_{28}$	453.0	184.24	6.602	27.908	
Tetrodecane	45.0	0.800	$C_{14}H_{30}$	486.0	198.25	6.668	29.730	
Pentodecane	43.5	0.807	$C_{15}H_{32}$	518.0	212.26	6.727	31.554	
Hexadecane	41.8	0.815	$C_{16}H_{34}$	549.0	226.27	6.793	33.307	
Heptadecane	40.3	0.822	$C_{17}H_{36}$	563.0	240.28	6.852	35.068	
Octodecane	38.6	0.830	$C_{18}H_{38}$	603.0	254.30	6.918	36.757	
NAPHTHENES								
Decanaphthene	46.8	0.792	$C_{10}H_{20}$	302	140.16	6.602	21.231	
Menthane (orthol)	41.6	0.816	$C_{10}H_{20}$	340	140.16	6.802	20.606	
Undecanaphthene	44.8	0.801	$C_{11}H_{22}$	361	155.184	6.677	23.242	
Dodecanaphthene	43.7	0.806	$C_{12}H_{24}$	387	168.192	6.718	25.034	
Tetradecanaphthene	39.1	0.826	$C_{14}H_{28}$	446	196.224	6.885	28.500	
AROMATICS OR BENZOL HYDROCARBONS								
Styrol	23.5	0.912	C_8H_{10}	295	106.08	7.595	13.967	
Mesitylene	31.8	0.865	C_9H_{12}	325	120.10	7.205	16.669	
Pseudocimol	29.3	0.879	C_9H_{12}	338	120.10	7.318	16.412	
Diethyl Benzol	31.8	0.865	$C_{10}H_{14}$	356	134.11	7.205	18.613	
Cymol	30.0	0.875	$C_{10}H_{14}$	347	134.11	7.286	18.407	
Amyl Benzol	32.8	0.860	$C_{11}H_{16}$	392	148.13	7.161	20.857	

REFINER
AND NATURAL GASOLINE
MANUFACTURER

EDITORIALS

AS integrated oil concerns buy the distributing properties of independent jobbers, it is well to remember that the jobbers who remain in business are generally the better class of business men. Stronger financial resources and abler management allow them to withstand the buying influence of integrated companies.

This condition places the integrated concern in competition with more resourceful competitors.

Independent jobbers gradually become a class which knows how to cope with the changing economic picture of the petroleum industry. Right now the greater number of them know that prices of gasoline in tank car lots are in their favor. Furthermore, they welcome the condition which brings the price of gasoline down to, or even below, its cost of manufacture.

This type of independent jobber will use low price periods as opportunities for enlarged profits. He knows he is able to buy gasoline cheaper than it should be sold. He knows he can sell more gasoline per station than can the integrated concern. That leaves him greater profit per retail outlet.

Neither is the resourceful jobber going to be shaken by the threat of a day when he will not be able to buy gasoline. He knows more about oil than the talk salesmen bring him. He knows there will be gasoline as long as there is a surplus of crude oil and he knows the surplus of crude may continue for many years.

All in all the refiner can classify the resourceful jobber as a business man who has conditions in his favor and knows how to make them profitable.

NO industry is going to be whipped by any one man or any one concern.

This fact has particular application to the refining industry today, because individual action seems to run in the direction of taking advantage of an industry. Movements gain headway which indicate a reduction in refinery runs only to be followed by figures which reveal an increase in still throughput. When the matter of closing down refineries over Sunday loomed up several weeks back the indication was for a drop in gasoline production.

But refinery runs came along a week later to reveal a higher figure of refinery operation.

Several concerns did reduce still throughput for the period. The only conclusion is that some individuals went into solitary conference and decided to take advantage of the anticipated drop by making more gasoline. So many did that that the result was a jump in refinery operations for the period.

There have been other instances of similar movements with similar results.

It gets back to the fact that one man, or one concern, is striving to whip an industry. So many individuals are striving for this victory that the result is defeat for themselves and for the industry.

Not many years back one individual set out to whip the world. He had ample assistance but the dream of world conquest was largely a one-man affair. An exile in Holland is proof sufficient that no one man is going to whip the world.

No one man or country will ever conquer the remainder of the world. Neither is any one concern going to conquer an industry. The business of making gasoline may stagger for a time under the impact of individual efforts to overcome sensible operation, but in the end sensible operation will be victorious. It is the individualist who will suffer.

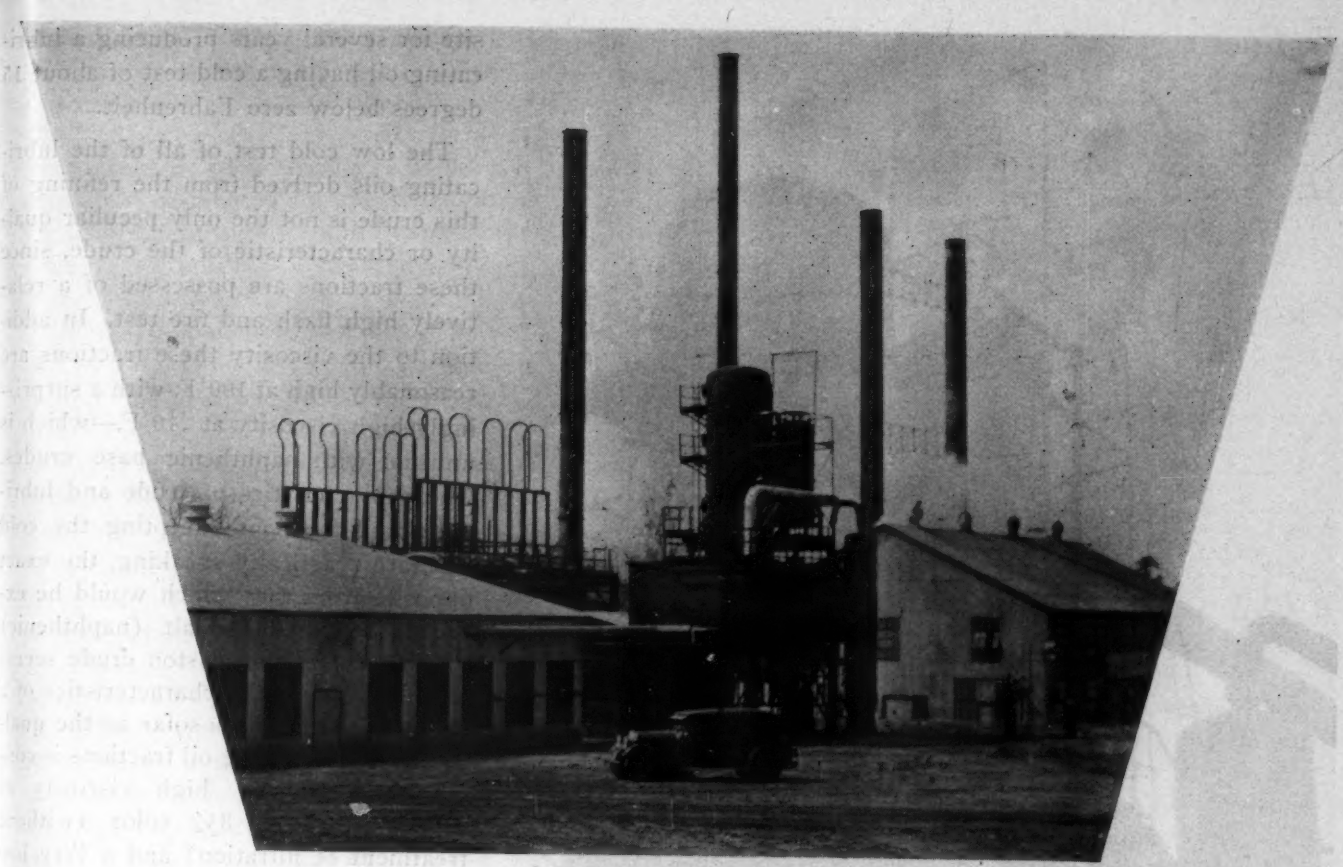
AFTER listening to the discussion between representatives of the Natural Gasoline Association of America and the membership of the Western Petroleum Refiners at Shreveport last month, one is inclined to arrive at the conclusion that refiners generally lack information or have not taken advantage of available information regarding the use of "Naturals" in blending.

Either the refiners have not given careful study to their requirements and therefore do not know what they desire in natural gasoline specifications which can be interpreted in terms of value to the blender, or they have not made a study of blending. And this condition we believe exists, despite the fact that 56 refiners stated in a report to the Natural Gasoline Association that they blended or wished to blend to volatility rather than to gravity.

The term "Jake-up" for blending is all too frequently used among refiners. It indicates that no thorough study has been given the fundamental physical laws governing solutions of volatile liquids and their admixture. It indicates that refiners fail to give proper study to the preparation of a proper blending base.

Discussions of the physical laws governing solution frequently have been repeated, and their application in this and other trade journals has been discussed during the past seven years. Yet refiners still are heard argumentatively discoursing upon the subject of whether end points and initial points may be lowered through the addition of natural gasoline to petroleum distillates of motor fuel range. Most of the current discussion points to the fact that refiners are still blending to gravity.

The Natural Gasoline Association has invited the Western Petroleum Refiners Association to present a paper incorporating its views as to specifications for "Naturals" at the convention in Tulsa in May. This is a step in the right direction for it is only through collective effort among refiners and natural gasoline manufacturers that a solution can be found which is acceptable to both seller and user of natural gasoline.



Bayou State Refining Company at Hosston, Louisiana. Boiler and electric power plant in background. Distillation equipment centrally located and run down tankage, vacuum pumps, manifolds and control room in the large metal building in the foreground.

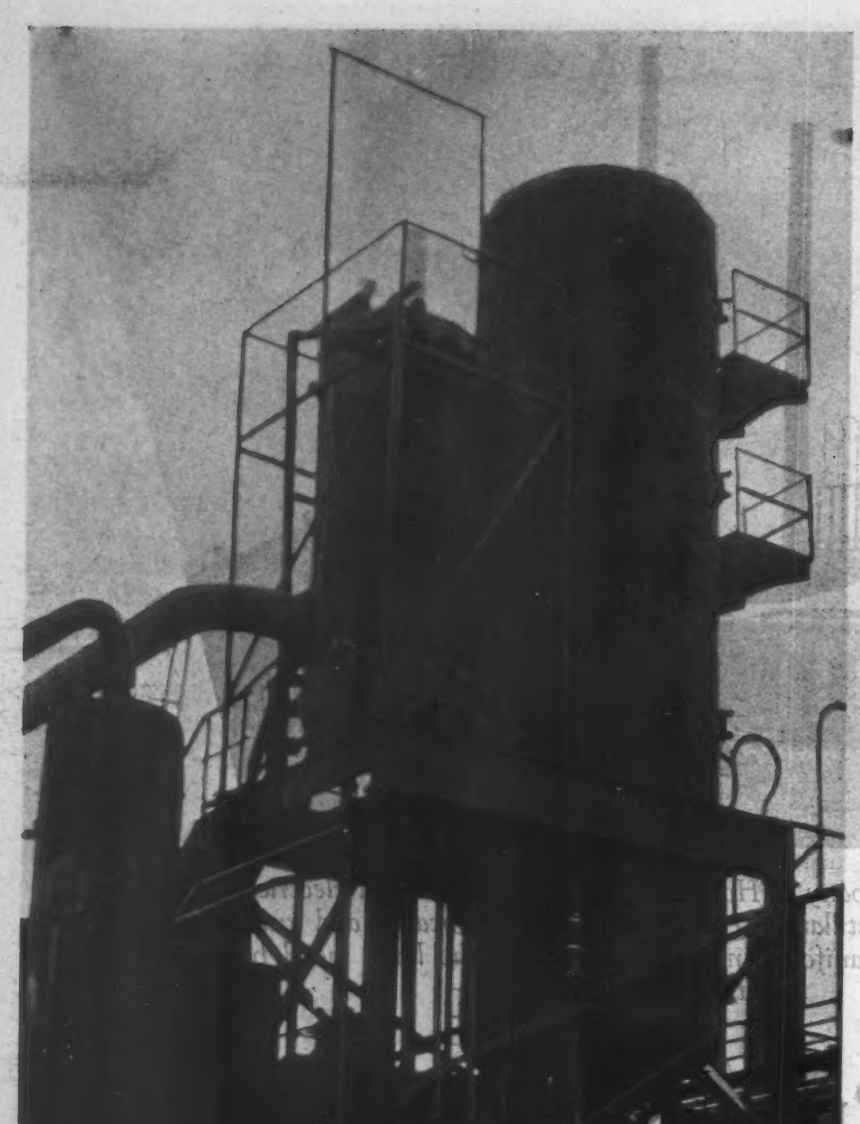
Schultz Process Applied to Hosston Crude

By GEORGE REID, *Associate Editor*

BAYOU State Refining Company, subsidiary of Bayou State Oil Corporation of Shreveport, Louisiana, operating its vacuum distillation lubricating oil plant of Schultz type at Hosston, Louisiana, occupies the peculiar position of controlling its own crude oil production and this oil is probably unique in its physical characteristics. The crude contains no gasoline or kerosene, has extremely low cold test, and with a gravity of 19.5 degrees A.P.I. yields 45 per cent of lubricating oils. While the plant and the crude production is small and not of general economic importance, it is, nevertheless of interest because of the peculiar nature of the crude and its products, and the type of plant employed for processing.

Briefly the plant consists of a tube still of 740 barrels capacity and two shell stills. Both the tube and shell stills are operated under as high vacuum as is possible to maintain and average around 28 inches. The installation is of the Schultz type, operating under these patents, and was erected for the company by the Graver Corporation of Chicago in the summer of 1928. A brief outline of this development was presented in The Refiner and Natural Gasoline Manufacturer, issue of April, 1928, page 108.

The products made at the plant consist of 45 to 48 per cent lubricating oils, the remainder going into residuum and gas oil tops, which are blended together to produce a fuel oil having a gravity of about 20 degrees A.P.I. Bayou State Oil Corporation formerly operated a small refinery on the present



Primary separator and fractionating equipment operating under vacuum.

site for several years producing a lubricating oil having a cold test of about 15 degrees below zero Fahrenheit.

The low cold test of all of the lubricating oils derived from the refining of this crude is not the only peculiar quality or characteristic of the crude, since these fractions are possessed of a relatively high flash and fire test. In addition to the viscosity these fractions are reasonably high at 100°F. with a surprisingly high viscosity at 210°F.—which is unusual with naphthenic base crudes. The characteristics of crude and lubricating oil fractions excepting the cold test, are practically speaking, the exact opposite from that which would be expected from an asphalt (naphthenic) base crude. The Hosston crude seems to possess all of the characteristics of a paraffin base crude insofar as the quality of the lubricating oil fractions is concerned; high flash, high viscosity at 210°F., three to 3½ color (without treatment of filtration) and a very low cold test; which on some fractions runs as low as 40 below zero F.

Forty-five per cent of the charge is converted into five cuts of lubricating oil ranging from 100 viscosity at 100 to 200, 300, 500, 750 and 1250 viscosity at the same test temperature. These fractions are of course, changed to any desired viscosity at 100°F. to meet requirements of purchasers. However, the lighter fractions have cold tests of minus 40 and minus 30°F. The 750 viscosity fraction has a cold test of minus 25°F. while the heavy fraction with 1250 viscosity at 100 has a zero cold test. The fraction with a viscosity of 750 at 100 has a viscosity of 110 at 210°F. In each case, or with each fraction the flash and fire points are reasonably higher than similar oils from other crudes. An additional property found in these oils is the quality of "oiliness" which is seemingly more predominate with lubes from this crude than any others within the writer's acquaintance. Further, it is not necessary to subject distillates from this

unusual crude to any form of chemical treatment or filtration, and yet produce lubricating oils finished off the stills of 2½ to 3½ color. A slight acidity formerly noticed in some distillates is now completely eliminated by the injection of a small quantity of sodium hydroxide in the fresh crude as it is charged to the plant.

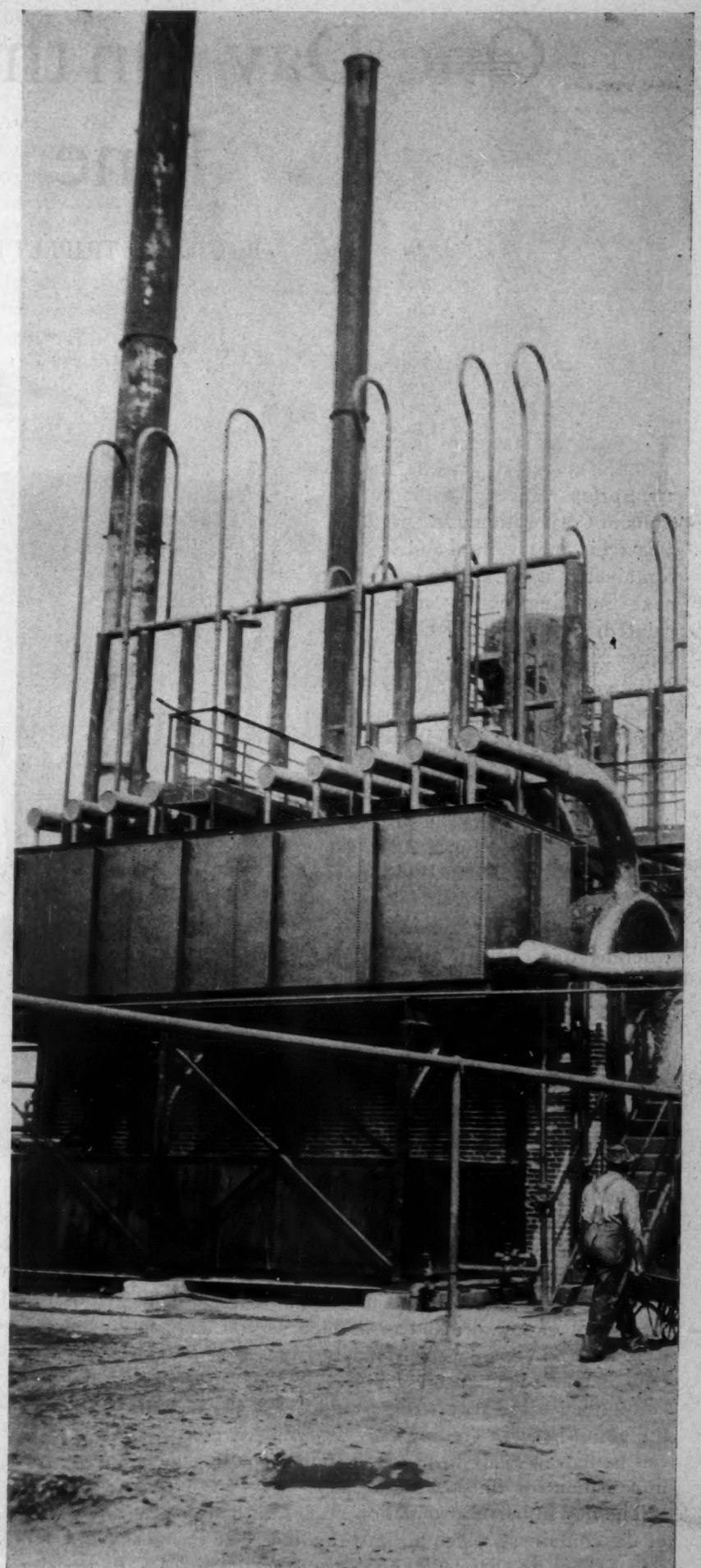
The Hosston field is very small and runs in a winding shoe-string fashion through the district for about seven miles. Production from this field is practically all controlled by the parent company which is developing new wells as needed.

The entire property, including the refinery, and all of the producing area is operated electrically. The company generates its own electricity through the use of Allis-Chalmers steam turbines driving generators of the same make, and produces sufficient current for the pumping of the company's 70 producing wells, for the lighting of the refinery, power for pumping and the like, for the town of Hosston. Four Casey-Hedges 250 horsepower boilers comprise the power plant. No steam is used in the operation of pumps, vacuum pumps, and the like on the refinery yard. All equipment of this type is operated by General Electric motors.

Crude is charged to the unit at the rate of 30 barrels per hour. At the pump a small stream of caustic is fed into the oil before it passes into two compartments of a Leach vertical fracto-condenser where it is partially preheated. From this point it progresses to the residuum exchanger of the same type, and then is conducted to the remaining two sections of the vertical Leach exchanger. Through this exchange system the crude is preheated to 435°F. from atmospheric temperature. At the same time the residuum leaving the large tower and passing through the horizontal exchanger has been reduced in temperature from 600 to 400°F.

Leaving the last of the exchanger

(*Continued on page* 114)



View of the two shell stills which are "batched down" under high vacuum.

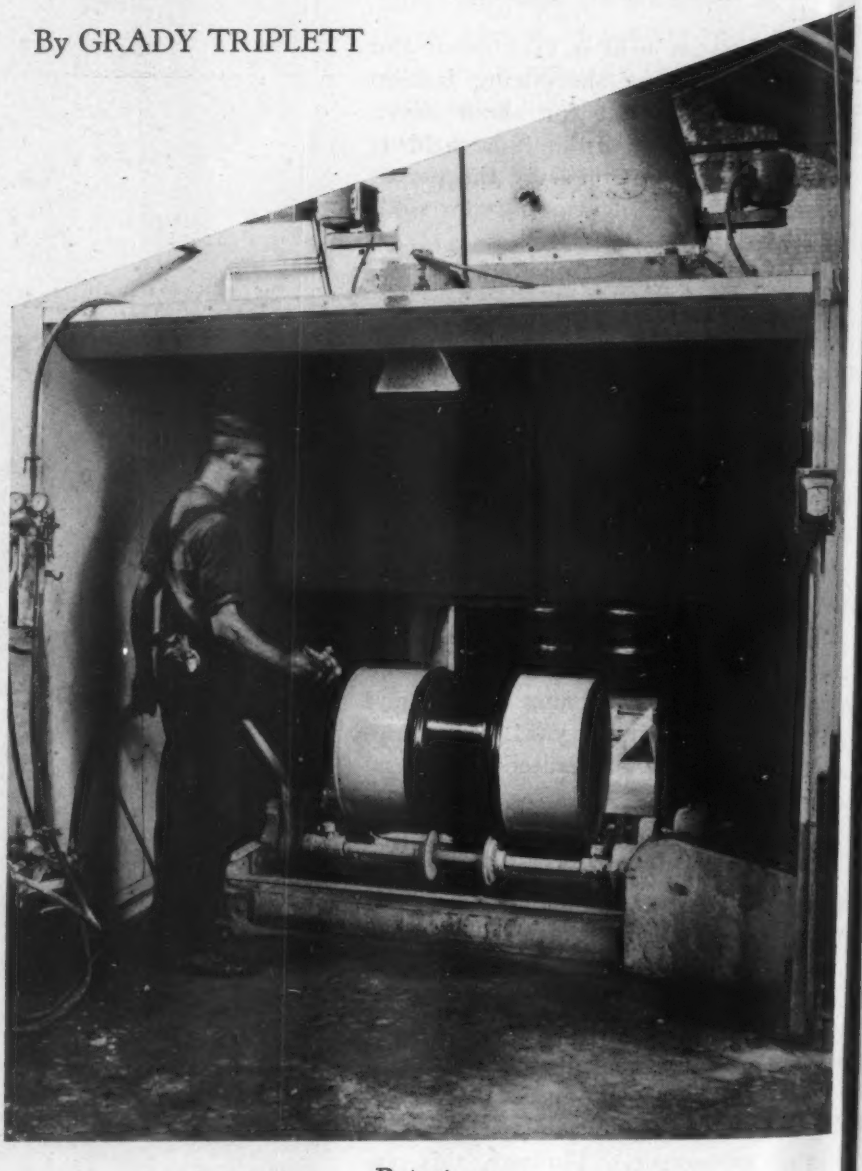
One Day On the Barrel Line

By GRADY TRIPLETT

IT'S all the matter of just a day for a barrel, at the Sand Springs refinery of Pierce Petroleum Corporation. One morning a barrel is a dirty, used and scarred container in a stack outdoors. The next morning it is a freshly painted, properly stenciled container ready for the filling room.

Between these two extremes of condition the barrel passes through successive states of inspection, steaming, cleaning, syphoning, second inspection, interior drying, painting and finally stenciling. Up to the interior drying state the work is done outdoors. From there the work is under cover.

Line production is the system whereby this concern provides its barrel requirements each 24 hours. Barrels start from a stack outdoors and pass from one process to another without breaking the chain of progress. In fact a part of the system may be styled a double line of production, for used barrels pass through a series of steps which are not essential in the case of new barrels. New barrels meet the used barrel line at the inspection point, to which used barrels are sent after being dried inside with warm air.



Painting

Barrel requirements at this plant run from 400 daily in seasons of low demand to as high as 700 daily in peak demand. Used barrels supply from 40 to 50 per cent of total requirements.

Returned barrels are stacked outdoors at the rear of the barrel house. The rows are so arranged that they can be moved easily to the first state of putting them in condition for finished lubricants.

The day in barrel production begins with selection of the containers which go into the line. The barrels selected are first moved to the steam rack. This rack is just above the ground, a long rack, with steam outlets from upturned pipes. The pipes are so separated that little space is vacant when barrels are upended and the pipes inserted in the bungs.

When the barrels are moved over the steam openings, live steam is turned on. There the barrels remain until the steam has sufficient time to loosen the oil on the inside walls.

THE BOILING BATH

After inside steaming the barrels are ready for the hot boiling bath. This is a chemical solution prepared to remove old paint, rust and scale. When

thrown in this bath, mechanical brushes begin their work of assisting the chemical solution. The barrels are under the work of both brushes and solution until all foreign matter has been removed.

A mechanical device trips the barrels out of the bath, where they are given a rinsing in warm water. A hose inserted in the barrels removes both chemical solution and other matter on the interior walls. At the same time warm water is being sprayed on the outside of the barrel.

From the rinsing, the barrels are juggled over to the draining rack. Here the barrels are tilted, so the fluid remaining from the interior rinsing will collect at the low point. The syphoning is done on this rack. After sufficient time for the fluid to collect the air syphon is inserted and under its pulling power any remaining fluid, together with other foreign matter is blown into the air.

The syphoning completes the work outdoors. Barrels are then ready for interior drying. The drying rack is similar to that for interior steaming. The barrels are moved indoors and up-ended, with each bung over a small pipe. Then warm air under slight pressure is turned on and the barrels left for sufficient time to complete the process.

Next comes inspection. Here the eyes of the workman are the measure of condition. A light is inserted inside each barrel and its cleanliness noted. Any barrel not thoroughly clean is sent back for another course through the cleaning operation, while the others proceed to the painting room.

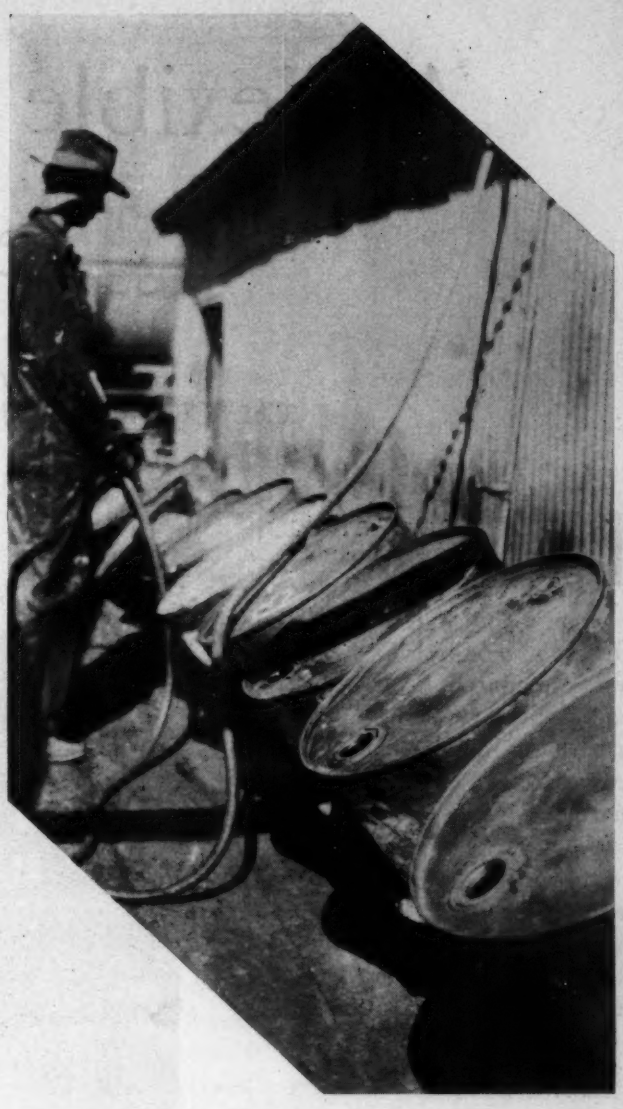
NEW BARRELS COME IN

New barrels come into the line at this point. They, of course, do not need the cleaning given used barrels but they must pass the inspection before going into the paint room. So both used and new barrels meet to form the line moving to the paint machine.

Painting is largely a mechanical process in the Pierce Petroleum Corporation's barrel department. Each barrel is placed on a machine, which rotates the container at the desired speed. Paint is sprayed on, while the barrel is rotating. Color combinations are easily met, when these permit painting in compliance with the movement of the barrel. Different colors may be put on the sides of the barrel and other colors on the ends.

Painting a barrel is a job of 40 seconds in this

Used barrels on the cleaning rack



Syphoning—the last step in cleaning.

plant. One man places the barrel on the machine; the man at the spray machine does his part; while the third removes the container.

Any painting, such as trademarks, or other designs must be done later, as is the stenciling.

The spray painting is done within a housing, which has three sides and is covered. The housing is a metal building, placed inside the painting room. The roof of the housing leads into a large stack, which passes upward through the roof of the building. Near the lower end of the stack are two motor driven blowers, arranged to force air upward through the stack and out of the building. The effect of these is to form a suction within the housing and around the point where paint is sprayed on each barrel. This suction removes both excess paint and odor from the room. The blowers are so effective that a person can stand within a few feet of a barrel, while it is being painted and not be bothered by either paint or odor. These blowers also assist in ventilating the whole painting room.

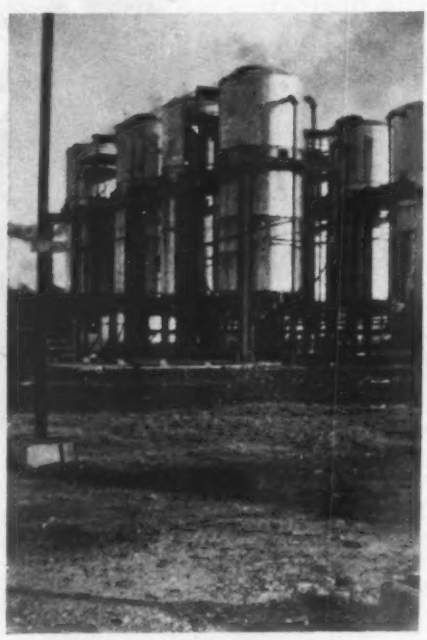
Ventilation, however, is no serious problem, as the walls of the building are amply provided with win-

(*Continued on page* 87)

A Flexible Continuous Treater

By L. C. ATCHISON
Chief Chemist, Crystal Oil Refining Corporation

THE desirability and at times the dire need of being able to change the method of treating gasolines is easily apparent to the head treator. A continuous treater designed for easy and rapid changes in treatment is adaptable in two distinct ways. First the throughput can be varied within wide limits; and second the chemical treatment can be radically changed within two or three hours.



View of new continuous chemical treating system at Crystal Oil Refining Corporation's Shreveport refinery.

Many installations have any number of settling drums from one to as high as 12 or 15. The majority of treatments can however be worked on four drums, the number used in this case. Each drum is approximately 18 feet high and eight feet in diameter, suitably supported in a vertical position, the bottom five feet above the ground. A two-inch drain to the sewer, a vacuum valve, a steam line, an air line, and sight glasses constitute the auxiliary equipment of each settling drum.

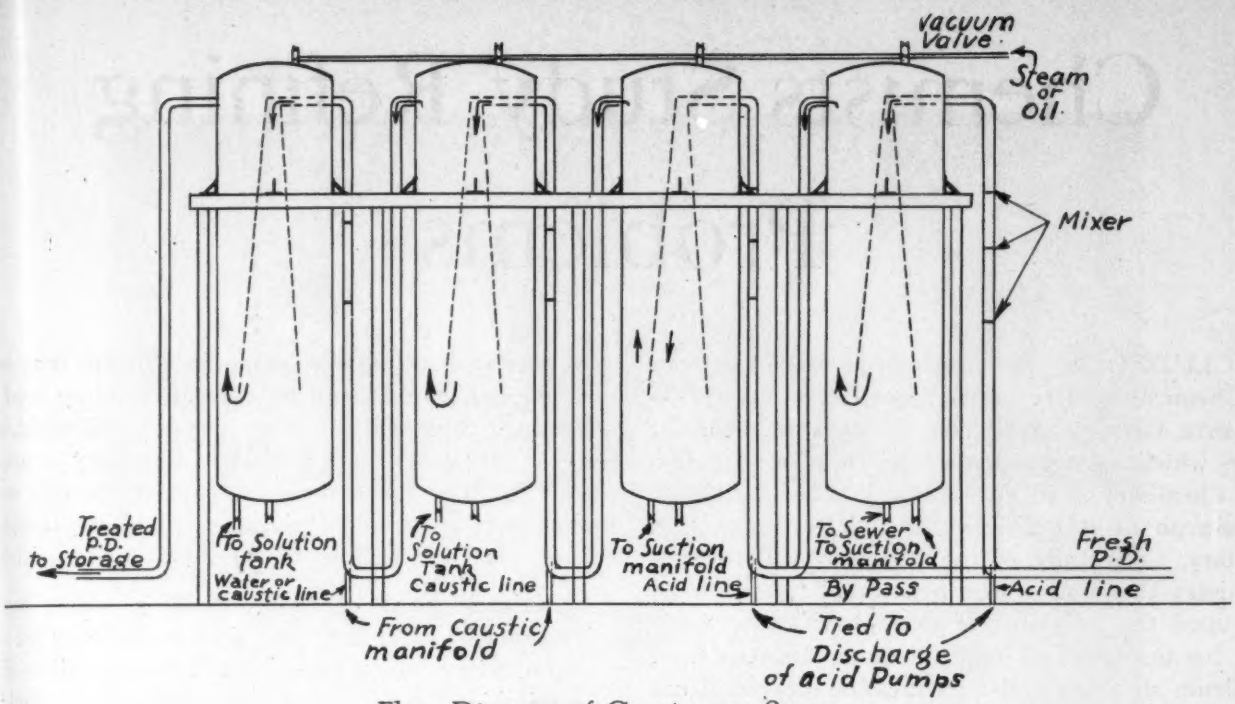
Variation in throughput is held to some limits by the chemical reactions that are carried out. Thus too slow a velocity keeps the material in contact with the acid too long, but too short a time seldom interferes if proper mixing is obtained. Inefficient settling will of course interfere and some improvement must be made over the usual empty drum. We placed a cone in each drum, the small end uppermost. The reagent and gasoline entering the small end of the cone are forced downward with a constantly decreasing velocity; at the bottom of the cone the material escapes into the drum proper and is forced upward with a like decrease in velocity. Each cone is four and 21 inches in diameter by 12 feet in length and is supported in the drum by angle iron.

In addition to the uniform decrease in velocity the mixture at all times is forced to follow the path that it would naturally take. Only one precaution need be noted: the reagent should always be drawn off fast enough to keep its level below the big end of the cone.

On the four-inch gasoline lines entering each settler two or three Duriron mixers are placed, the reagent being introduced three or four feet ahead of the first mixer.

The first two drums are used for acid treatment. Each reagent line concerned runs to the same manifold, this in turn is tied to the discharge side of the pumps; three being provided. These pumps can take suction on either drum or on the fresh acid storage. Thus the treatment can be all fresh acid, all sludge acid; or any combination of the two. It is also possible to by-pass any drum should the occasion arise.

The last two settlers are used for caustic treatment. As before, the reagent lines run to a suitable manifold connected to the pump discharge. The three pumps for this manifold take suction from any one of three square tanks. Any known liquid reagent may be made up in these tanks. As the reagent is



Flow Diagram of Continuous System

sed the excess flows from the bottom of the drums ack to the tank, or to the sewer as desired.

We have at present two of these treaters in operaon, one for cracked gasoline and one for straight n gasoline. The cracked gasoline in a batch agitor required six pounds of acid per barrel and 15 arrels of 20 Be. caustic to a batch for neutralization. now takes one to two pounds of acid per barrel and out one-fifth as much caustic. The material is eated with a 45 Be. sludge acid neutralized at once ith 16 Be. caustic and water washed. Sludge acid dumped and fresh acid added whenever the gravity ets below 40 Be. At no time is all the sludge umped at once.

The straight run gasoline is not acid treated at present but is sweetened. Two different gasolines are run through; one requires doctor solution alone, the other caustic alone. These gasolines are from different crudes of course. They also have different end points but in going through the treater only 90 odd barrels of gasoline is thrown off specification as a result of forcing one ahead of the other.

Stop cocks have been used throughout and none of these show any signs of corrosion. No part of the equipment is lined with a protective coating but a year's use has not shown any corrosion. One treator can operate both treaters at the same time without being rushed as it is only necessary to watch the pumps and gauge glasses.

One Day on the Barrel Line

(*Continued from page* 85)

ows. There are other windows at the apex of the oof. These windows also make it possible to carry n work in daylight without artificial lighting.

STENCILING AT NIGHT

The room, however, is equipped with excellent ghting facilities, for the one-day production of the partment makes it necessary for part of the work be done at night. Up to the point of painting the arrels on the spraying machine, all work is cometed during daylight. Barrels, after leaving the inting machine, are left to dry, so they will be ady for stenciling and painting trademark insignia. This stenciling is done after midnight. From shipents for the next day, a sheet is made in the office, owing how many barrels must be given a certain encil, as well as other markings. A special crew comes to the plant for this work. The stenciling is completed before time for the day-time shift to come on the job.

So the crews, which come to work each morning, begin at each end of the barrel painting line. One force begins by removing finished and stenciled barrels from the painting room, into the shipping room, which is adjoining. Outside, another force begins its work by selecting the barrels, which must go through the cleaning and painting process that day.

All filling is done by automatic devices. Whether the container is a four-ounce can to hold oil for household purposes, or a large drum, the amount of liquid is measured accurately by machinery.

The shipping platform, is just off the filling room, so that barrel cleaning, painting, filling and loading are in effect within one line of production.

Chemists Study Refining Problems

INCLUDED in the program of the American Chemical Society at its annual meeting at Atlanta, Georgia, April 7 to 11, were 10 technical papers which were read before the Division of Petroleum Chemistry at its two sessions. J. Bennett Hill, is chairman of this division, and C. R. Wagner, is secretary. The work of the Division of Petroleum Chemistry this year was concentrated for the most part upon the problems of desulphurization, treatment for the chemical removal of mercaptans from petroleum distillates, the purification of petroleum products, and gasoline consumption problems, including factors affecting knock ratings. Abstracts from the papers presented at this meeting follow:

Motor Fuel Volatility. III. The Relation Between Atmospheric Temperature, Fuel, Volatility, and Car Performance. Geo. G. Brown and C. L. Nickolls.

Tests on different types of engines both in the laboratory and on the road indicate that the relationship between A. S. T. M. distillation and effective volatility reported by J. E. Miller and G. G. Brown at the Minnesota meeting is generally applicable to practically all commercial types of motor car engines. Atmospheric temperature and car performance have been directly related to the different points on the A. S. T. M. distillation for cars equipped with radiator shutters and those not so equipped.

The 10 per cent point on the A. S. T. M. distillation is found to indicate the lowest temperature at which the car can be operated. The 35 per cent point on the A. S. T. M. distillation is found to indicate the lowest temperature at which the car can be operated without the choke or at which entirely satisfactory performance can be obtained with use of the choke. The 60 or 65 per cent point is found to indicate the lowest temperature at which entirely satisfactory performance can be obtained on modern cars equipped with accelerating devices. Fuels whose 90 per cent points are below 392 degrees F. show a noticeable loss in power and acceleration when the motor is thoroughly warmed up and operated with heated manifold.

True Boiling Crude Analyses. G. A. Beiswenger and Wm. C. Child.

An improved method for the determination of the quantity and quality of products obtainable from a petroleum crude oil is presented. The procedure consists of distilling the sample in efficient true boiling equipment followed by correct blending and inspecting. The analysis is inexpensive and rapid, and yet is accurately reproducible and very comprehensive. The finished report consists of one summary page and a curve giving distillations, temperatures, gravities, refined oil and Saybolt viscosities.

Maximum yields of more valuable products can be determined and at the same time yields may be correlated with refinery operation. Many possible yield combinations can be predicted. Moreover, considerable additional information is obtainable, such as molecular weights and flash temperatures necessary for pipe still operations.

The Problem of Establishing the Identity and Purity of a Hydrocarbon Obtained from Petroleum. Edward W. Washburn.

The evidence in support of the identity and purity of most of the hydrocarbons reported as having been isolated from petroleum is inadequate. Suitable tests for purity, and evidence for identity are described and discussed and a procedure is suggested. It is recommended that in addition to the necessary proof of purity at least the five properties, refractive index, density, boiling point, freezing point, and halogenation behavior, be reported on all petroleum fractions for which identification and/or purity is claimed.

The Purification of Normal Paraffin Hydrocarbons by Chlorosulfonic Acid Treatment. Alvin F. Shepard and Albert L. Henne.

The preparation of pure normal paraffin hydrocarbons from gasoline can be achieved by combining fractional distillation and treatment with chlorosulfonic acid. The preparation of pure n-decane is given in detail as an example of the method.

Autoxidation of the Amylenes. Julius Hymen and C. R. Wagner.

Although considerable work has already been done on the various phases of autoxidation, the field is of such magnitude that the special divisions of the subject suffer through lack of sufficient definite information concerning details.

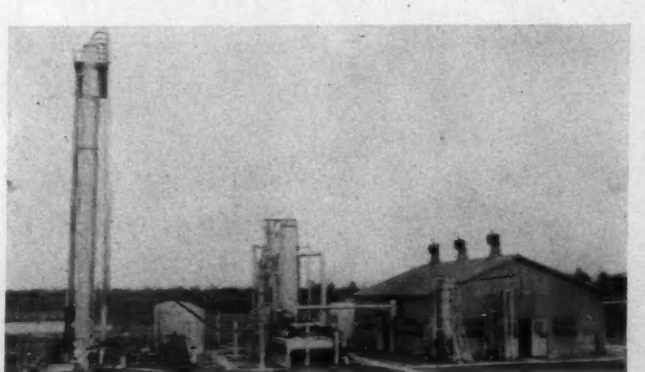
One such division has to do with the autoxidation of cracked gasolines. Because of the complex nature

(*Continued on page* 95)

Interior of plant control laboratory

Latex Gasoline Plant Has Full Automatic Control

LIKE many of the absorption type natural gasoline extraction plants in North Louisiana, the plant of Magnolia Gas Company's Latex, Texas, compressor station is of the high pressure type. This unit, which was installed about five years ago, was designed for a working pressure of 500 pounds per square inch. Natural gas from the gas company's large pipe line booster station is passed through the seven Braun absorbers and the gasoline content of .2 gallon per 1000 cubic feet is extracted before the gas enters the main pipe line to be transported to Beaumont and other Southern Texas points.

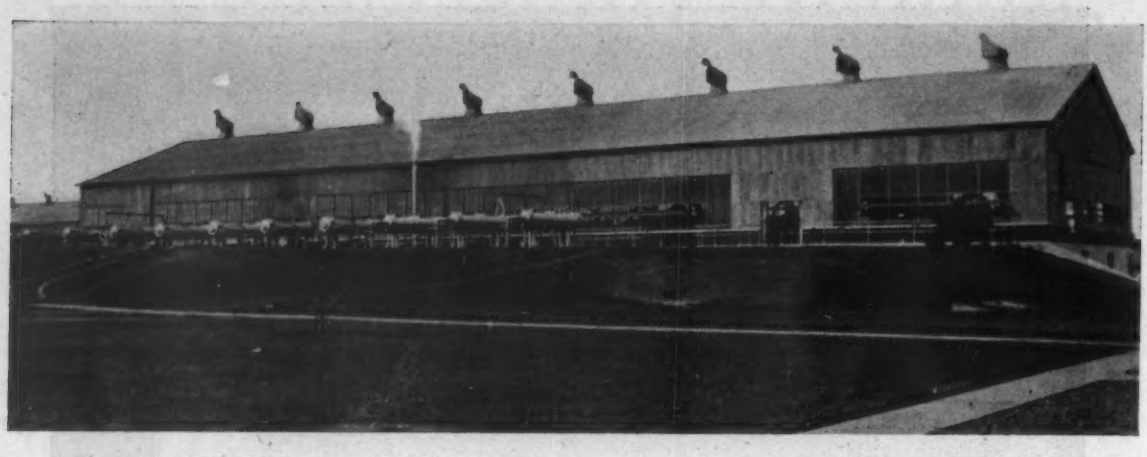


View of absorption, distillation equipment and compressor-control room.

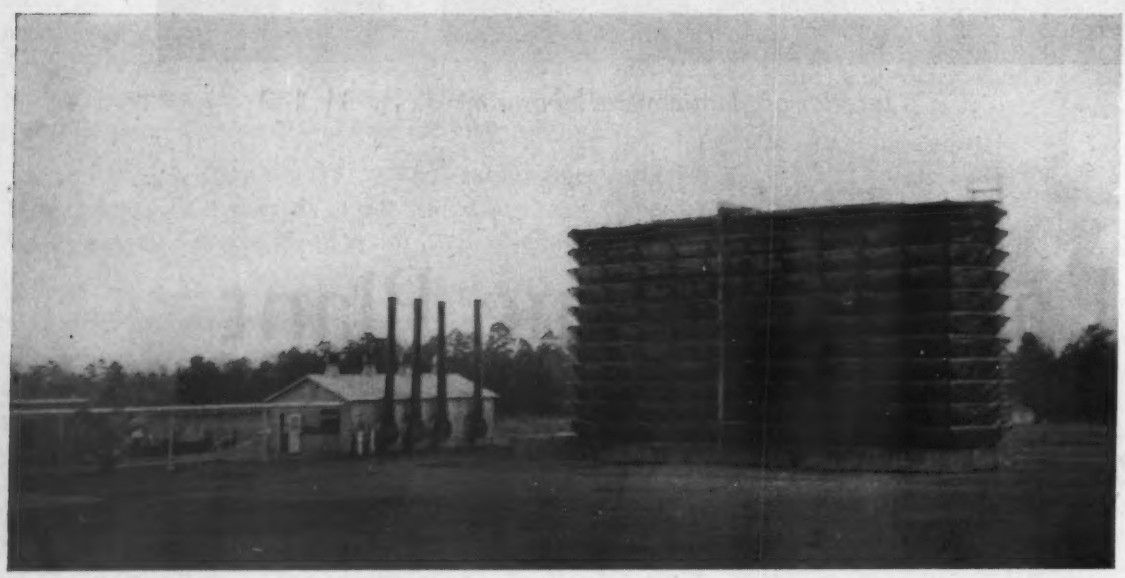
Each of the seven absorbers has a capacity of 5,000,000 cubic feet daily and from the total of 30,000,000 feet the absorption process extracts about 5000 gallons of Grade AA gasoline daily. The working pressure in the absorbers is 450 pounds per square inch at present.

Through the provision of adequate control and regulatory devices the mechanical operation of the plant is entirely automatic. In the boiler room, which like the remainder of the plant, is kept spotlessly clean, automatic control of boiler fires and water supply, both fresh and returned condensed water, is constantly maintained. As a safety feature each of

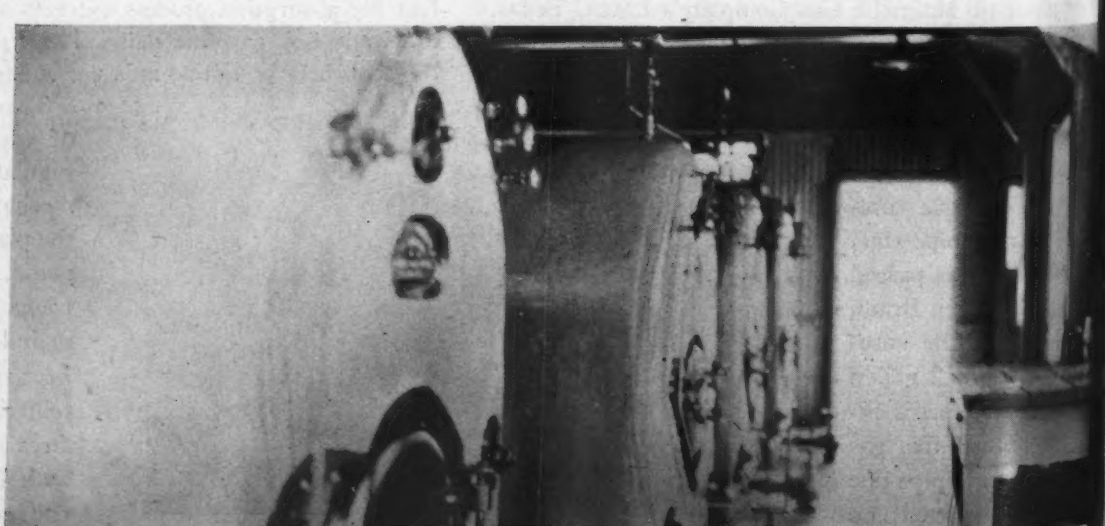
Plant Layout and Equipment



Magnolia Gas Company's gas compression station adjacent to the gasoline plant.

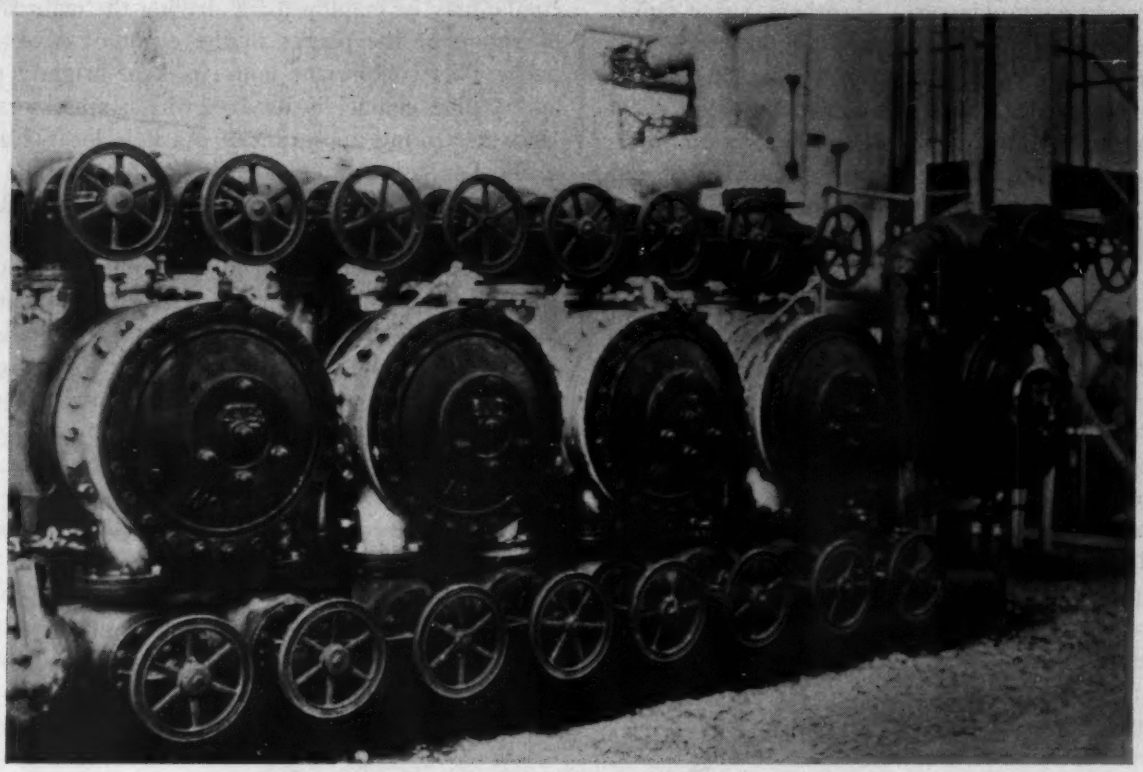


Laboratory, power house and water cooling tower.

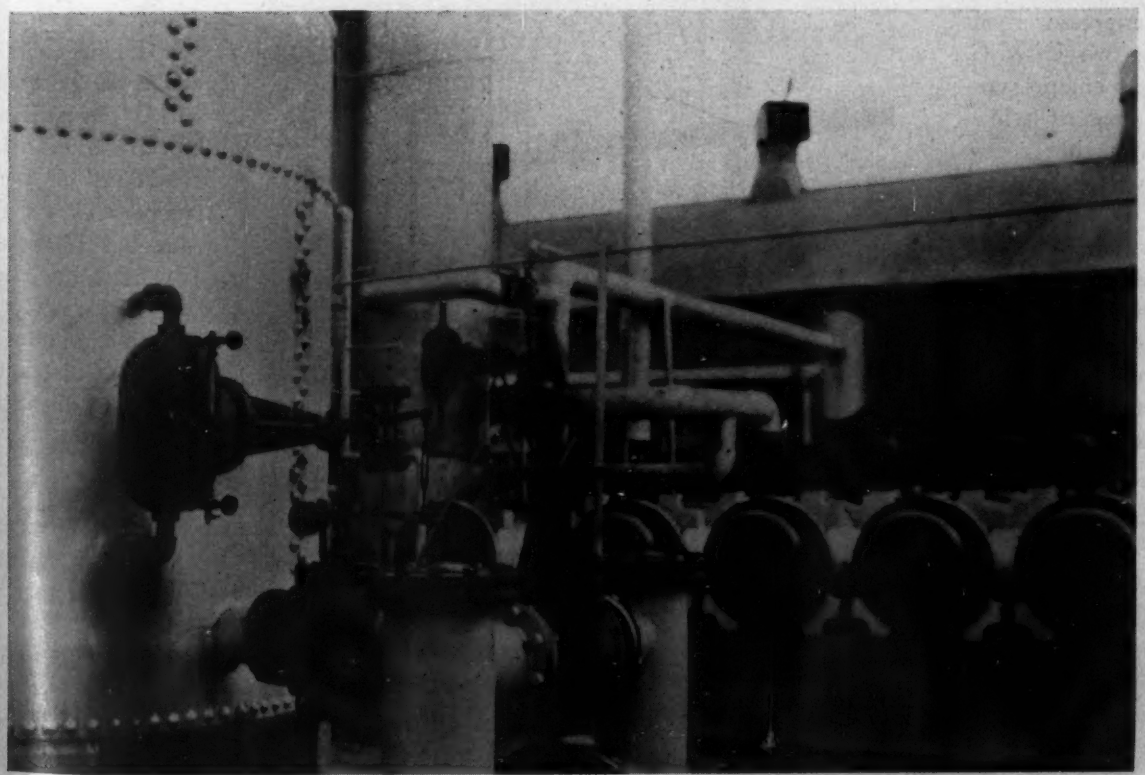


Interior of boiler house. Boilers are fully automatic in control.

Magnolia's Latex Gasoline Plant



Heat exchange and preheater equipment in compact lay-out.



Level control equipment on accumulators and absorbers.

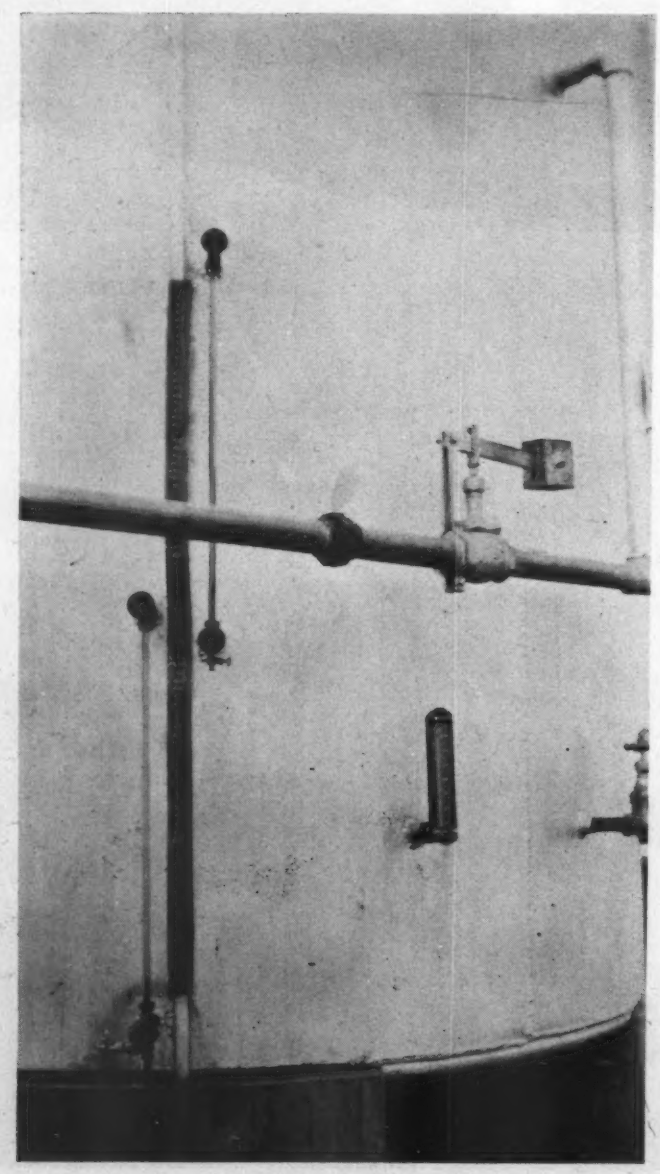
the "Oilwell" horizontal return tubular boilers operating at 110 pounds steam pressure are equipped with heavy mesh wire screen wrapped securely around the level indicating gauge glasses. Absorbers, surge tanks, dewatering tanks and the like are all provided with Fisher Liquid Level controllers which take care of the constant even flow of liquid from such containers. All of the usual temperature and pressure control and indicating instruments are kept permanently in place and operating. The plant operation is controlled, checked and supervised from the control laboratory located nearby.

The laboratory is well equipped with chemical and physical testing apparatus for use in analysis of natural gas, gasoline and absorption oils. This latter is a 36 A.P.I. gravity petroleum product of narrow boiling range. Before its use it is subjected to analysis by distillation, a test for unsaturates, and an emulsion test, in addition to the usual routine tests for doctor, flash and fire.

Raw gasoline from the plant is stabilized in the accumulator tanks by means of heat applied through steam coils. Vapors driven off are collected from the accumulators and storage tanks and loading rack, and are recompressed and returned to the absorbers. In the compressor room there are two C. & G. Cooper gas engine compressors, one of which is employed in recompression of the light vapors. The second gas engine is employed for the purpose of belt driving vertical triplex pumps of Goulds type which are used to circulate absorption oil to the absorbers. These pumps, one of which is a stand-by unit, are belt driven from a main drive shaft. Other belts operate the centrifugal water circulating pumps. By means of a coupling either gas engine may be employed for driving the main shaft for operation of the pumps in the event of necessary repairs. This compressor house is kept brightly painted, and a blue enamel is used on the compressors which lends a striking appearance. As it is located adjacent to the distillation and condensing system and the absorbers, the plant operators control room is placed in one corner of the compressor house.

Live steam is employed in the preheaters and in the coils placed in the accumulators. Exhaust steam is employed in the distillation equipment for agitation purposes. All of the water which is later condensed is returned to the boilers for re-use. On the accumulator tanks with their gauge glasses for indicating gasoline levels the operators have placed permanent copper gauging strips. On these strips the reading in gallons for each inch is imprinted. Through this means the operator is enabled to easily determine his gallonage production and to correct any variation from the usual recovery. Similarly permanent gauge strips or poles are attached to the main storage tanks containing the finished gasoline.

Gasoline production from the gas being processed meets Grade AA specifications upon being stabilized in the simple manner described, and also has additional quality of being non-corrosive and doctor sweet, which eliminates the necessity of installation and operating chemical treating equipment.



Gasoline tanks are provided with metal gauging strips reading direct in gallons.

Air Preheaters and Oil Stills

By EMIL CREUTZ
Research Engineer, Air Preheater Corporation
New York

THE use of preheated air in connection with oil stills for recovery of otherwise wasted heat and producing more desirable furnace temperatures are becoming matters of increasing importance in the economical operation of refineries. Past indifference to this practice has been due to the comparatively low price of fuel oil at the refinery and to the correspondingly low return that could be expected from the preheater. Also, furnace temperature in the old type of furnaces with very small radiation surfaces might be too high when preheated air is used, especially as oil is not able to absorb heat as rapidly and to the same extent that water does. Therefore, there is a possibility of tubes being ruptured or melted from too high temperature of the surrounding gas. However, high saving in fuel when using preheated air in connection with the operation of oil stills is obtainable with a furnace temperature within the safety of the tubes.

Recent improvements in air preheater construction provide for the handling of gases of high temperature with apparatus of lower initial cost and without the destructive effects that previously cut down the net money return on the preheating apparatus. The air preheater may therefore be applied economically for utilizing recovered heat to supplement that of the additional fuel burned.

Continuous operation of the oil still is necessarily accompanied by a high temperature of the flue gases, usually between 800 and 1000°F. Therefore, an air preheater in connection with the still is essential for increasing the heat efficiency. The preheated air in the oil still can be applied directly as in a boiler furnace.

With a still, however, if an old type is used, operation at a higher excess of air may be necessary where the preheated air is used in order to keep the temperature of the flue gases entering the tubes below a certain degree, and in that case, of course, the saving will not be as great as though the oil could be burned with a lower percentage of excess air. A better arrangement , if an old type of still is used, is to re-circulate part of the flue gases. That means that the air to be preheated will be only the amount required to burn the fuel oil with reasonably good CO_2 and the corresponding flue gases will be exhausted to the stack. All other gases necessary to keep the desired temperature in the furnace will be re-circulated.

In the new type of oil still furnaces, air preheated to any degree may be used. These furnaces are built with a great amount of radiation surface. When the oil is burned, the temperature of the gases will be cooled down to the desired degree before they reach the tubes, due to the radiation between the hot gases and the heating surface.

SAVINGS INDICATED

The examples given below show the saving obtainable in using each of the above mentioned arrangements. All these examples are based on the same assumptions, as follows:

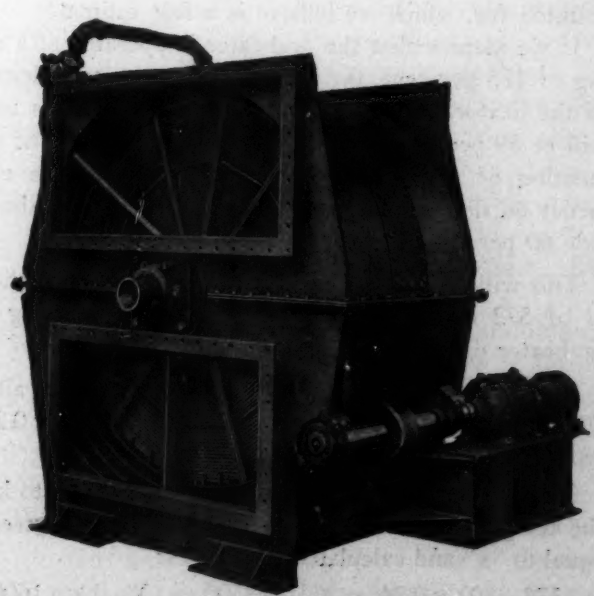
Heat content of oil burned, 18,500 B.t.u.

Amount of flue gas leaving still, 50,000 pounds per hour.

Temperature of flue gas leaving still, 900°F.

Temperature in furnace before entering low row of tubes in still, 1600°F.

We assume that the CO_2 in the flue gases leaving the still when operation is accomplished with cold air is equal to 7.7 per cent. Assuming also that no leakage exists in the still, the air required for combustion per pound of oil, based on 7.7 per cent of CO_2, will be 28.6



Ljungstrom Air Preheater

pounds. The gas per pound of oil will be 29.6 pounds. The air required corresponding to 50,000 pounds of flue gas equals $50{,}000 \times \frac{28.6}{29.6} = 48{,}400$ pounds.

The theoretical temperature in the furnace if no radiation takes place will be as follows:

$18500 = (T.-80) \times 29.6 \times 0.25$.

T = Theoretical temperature in degrees Fahrenheit.

80 = Outside air temperature in degrees Fahrenheit.

29.6 = Pounds of gas per pound of oil burned.

0.25 = Specific heat of gases. We have assumed 0.25 due to the high temperature of the gases.

This equation indicates a theoretical furnace temperature of 2580 degrees.

If the radiation within the furnace cools the gases down to 1600 degrees we will have as follows:

B.t.u. per pound of gas absorbed by radiation (2580 —1600) x 0.25 = 245.

Total B.t.u. per pound of gas (2580—80) x 0.25 = 625.

Heat absorbed by the still due to convection = 380 B.t.u.

Amount of oil burned in the still per hour $= \frac{5000}{29.6} = 1690$.

B.t.u. liberated in the furnace = 1690 x 18500 = 31,250,000.

If we assume 60 per cent efficiency of the still, the B.t.u. utilized will be 0.6 x 31,250,000 = 18,750,000.

Assuming 0.24 as the specific heat of the gas at stack temperatures, the stack loss $= \frac{(900-80) \times 0.24 \times 29.6}{18{,}500}$ = 31.5 per cent.

The assumed still efficiency corresponds to 8.5 per cent losses due to radiation, unburned fuel, and unaccounted for, which we believe is a fair estimate.

If we assume that the preheater is operated at a rating of 175 per cent, the corresponding mean efficiency of the heater, providing a small size of heater is used, will be 59 per cent. Using the standard method of calculation of the Air Preheater Corporation, the efficiency on the gas side equals 58 per cent and on the air side 60 per cent.

This will give an air temperature leaving the preheater of 572 degrees, and a gas temperature leaving the preheater of 424 degrees.

The B.t.u. per pound of oil at 80°F., providing air of 572 degrees is used, will be equal to (572—80) x 0.24 x 28.6 + 18500 = 21880 B.t.u.

The air required at 572° F. per pound of oil to keep the temperature in the furnace below 1600 degrees is equal to "x" and calculated as follows:

$(572-80) \times 0.24 \times X + 18500 = (X+1)\ (1600-80) \times 0.25 + 245\ (X+1)$

We have assumed that the same number of B.t.u. per pound of gases as above is transferred due to radiation, or 245 B.t.u.

This equation indicates "X" equal to 35.3, which means that 35.3 pounds of air will be required per pound of oil.

If we calculate the performances for the preheater assuming the same preheater load as above, we get the same temperatures of air and gas leaving the preheater that is, 572 degrees and 424 degrees, respectively.

The stack loss, based on temperature of gas leaving the preheater and 29.6 pounds of gas per pound of oil is 13.2 per cent.

The increase in still efficiency if the same amount of air per pound of oil could be used as when the still is operated without preheater is equal to 31.5 — 13.2 = 18.3 per cent.

The stack loss based on the same temperature as above but 36.3 pounds of gas per pound of oil is 16.5 per cent.

The increase in still efficiency = 31.5 — 16.5 = 15 per cent.

From these figures, the losses in still efficiency due to the extra air is necessary to keep the temperature of the furnaces below 1600 degrees is equal to 3.3 per cent. If the new type of furnace is used, all the heat can be utilized in a proper way.

The above problem can be solved in a more economical way if part of the gases are re-circulated. If, for instance, the oil is burned at reasonably good CO_2 and the corresponding gases are used to preheat the air, we get the following results: Assume the oil is burned with an amount of air corresponding to 10 per cent of CO_2. The air required per pound of oil is 21.25 pounds and corresponding gas is 22.25 pounds. The stack loss, assuming a temperature of the gases of 900 degrees, is 23.7 pounds. If about the same radiation losses as before are assumed, the still efficiency without heater is 68 per cent. If 59 per cent of the heat in the gases from the oil burned is recovered, the still efficiency with preheater is 82 per cent.

If the same calculation is made for the above problem, the temperature of air leaving the preheater is 572°F. and that of gas leaving the preheater is 424°F. The amount of oil burned is 1235 pounds per hour. The amount of gas to be re-circulated can be calculated in the following way:

GAS TO OIL RATIO

The B.t.u. per pound of oil including B.t.u. in air required per pound of oil is equal to the B.t.u. required to heat the gases from combustion to 1600 degrees, plus the re-circulated gases from 900 to 1600 degrees, plus the radiated heat.

In this case the necessary amount of gas to be re-circulated will be around 35 pounds per pound of oil. The re-circulated gases do not take any part in the combustion. They merely serve as a regulator entering the

combustion chamber at 900 degrees, absorbing heat from the combustion gases, increasing in temperature to 1600 degrees, delivering heat to the oil still, and leaving same at 900 degrees, to be re-circulated again.

The amount of heat absorbed by the still due to radiation given above has been calculated from a test made on a still equipped with a Ljungstrom Air Preheater.

All the gases could be taken through the preheater. In that case the temperature of the air entering the combustion chamber would be somewhat higher, indicating that the still efficiency might also be higher or the preheater better utilized if all the gases go through the preheater. However, the temperature of the gas leaving the preheater is higher if all the gas goes through the preheater and consequently more heat is lost in the stack.

When the gas is re-circulated direct from the outlet of the still at the back of the combustion chamber the heat from the still is given back to the still. If the gases are re-circulated from the outlet of the preheater, the latter takes heat from the still and gives part of the heat back to the still and part to the air in the preheater. This will explain why the still efficiency might be lower, even though the air temperature is higher. The amount of oil burned in this case is 1235 pounds per hour. If the furnace in the still is provided with a sufficient amount of radiation surface, high temperature air can be used without additional diluting. In that case, the fuel saving will be exactly the same as when gas is re-circulated from the still outlet, providing that oil is burned at the same CO_2 in both cases, but, of course, if a large amount of gas does not have to re-circulate, there will be a saving on the installation cost of fans and on the fan horsepower requirement.

Air preheaters which have been calculated on the basis of the examples given have now been in use in this country for approximately four years. In some instances the exhaust gases of as high temperature as 1400° F. have been reduced by the preheater to 630 degrees in heating the air from 70 degrees initial to 920 degrees final temperature.

Chemists Study Refining Problems

(*Continued from page* 88)

of such gasolines, it was decided to work with prototypes of the autoxidizing constituents, that is, the olefines. The amylenes may be considered as such prototypes. In the preparation of the amylenes, new and interesting data were obtained as to the nature and physical constants of several of the group. Rates of oxidation of the amylenes were measured, showing distinct differences according to the nature and position of the groups adjacent to the olefine bond.

The Behavior of Mercaptans with Copper Sulfide. K. H. Slagel and E. Emmet Reid.

The primary mercaptans from methyl to nonyl are largely removed from their solutions in benzene by shaking with copper sulfide. The adsorption increases rapidly from methyl to butyl, is greatest from butyl to heptyl, and falls off with octyl and nonyl. Copper sulfide removes these mercaptans much better than does copper powder. Many other adsorbents have been studied. A dilute solution of a secondary mercaptan dissolves copper sulfide to form an orange-red solution. Copper is even more soluble than the sulfide in such a mercaptan solution, approximately one atom of copper dissolving for each molecule of secondary mercaptan present. The nature of the products obtained is being investigated.

The Partition of Mercaptans Between Benzene and Caustic Soda Solutions. L. M. Ellis, Jr., and E. Emmet Reid.

The primary mercaptans from methyl to nonyl and the secondary from isopropyl to *sec*-nonyl have been partitioned between benzene and different concentrations of caustic soda solution. Methyl and ethyl mercaptans can be efficiently removed from hydrocarbon solution by shaking with caustic soda solution, but the percentage so removed falls off rapidly as the molecular weight of the mercaptan increases. Only traces of the higher mercaptans are taken out by caustic soda wash. Benzene has been used as the solvent for the sake of reproducibility. A part of the experiments have been repeated with pure heptane and similar results obtained.

The Reactions of Some Mercaptans With Alkaline Sodium Plumbite Solutions. Emil Ott and E. Emmet Reid.

It has been found that both basic and neutral lead mercaptides are formed when benzene solutions of the mercaptans are shaken with doctor solution. It has been found that the formation of lead mercaptides is incomplete in the presence of dilute acids. In some cases it has been possible to isolate the basic lead mercaptides practically free from the neutral salt. The lead mercaptides which have been studied behave like organic compounds and are mostly soluble in organic solvents.

The Autoxidation of Lead Mercaptides. Emil Ott and E. Emmet Reid.

It has been found that both basic and neutral mercaptides take up oxygen from the air to form peroxides of high oxygen content. These are usually less soluble in hydrocarbons than the original mercaptides and may separate from these solutions on exposure to air. The preparation of similar peroxides by the action of hydrogen peroxide on mercaptan solutions has been studied also. One of the first mentioned peroxides has been found to be a catalyst in the oxidation of ethylbenzene by air at 100 degrees.

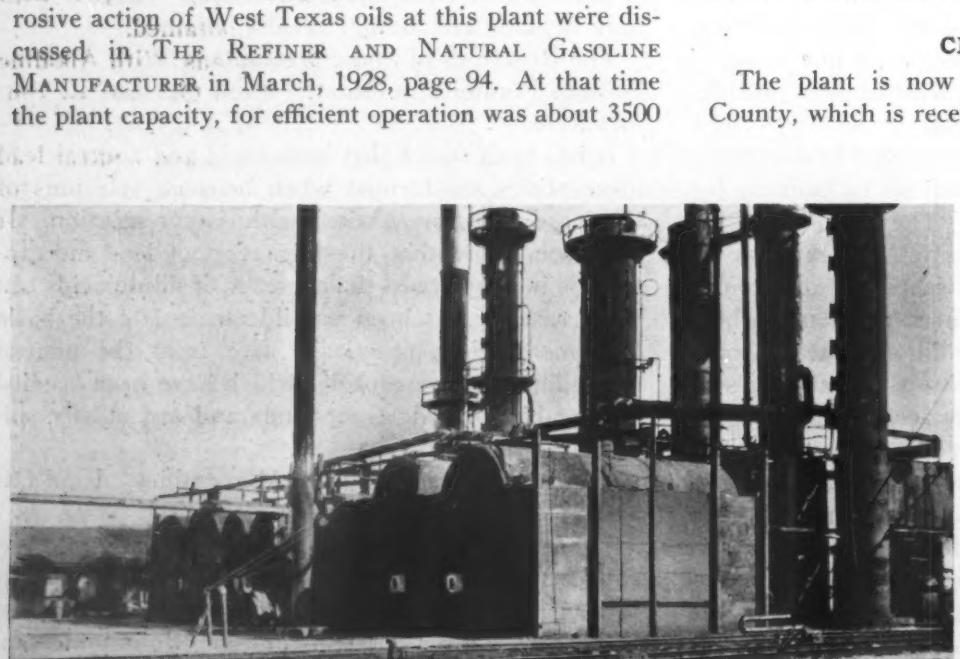
Redesigning Improves Efficiency At Chalmette

By GEORGE REID
Associate Editor

DURING the past two years Chalmette Petroleum Corporation, New Orleans, has been steadily improving its manufacturing facilities at its refinery seven miles south of the city. The program involved the rearrangement of distillation equipment, the addition of more bubble towers, a cracking unit, continuous treating system for chemical refinement of pressure distillate, an acid concentrating plant and a complete absorption type stabilizing system.

This plant was among the first refineries outside of the West Texas refining district to operate on the sulphurous crude production from Winkler County, Texas, and was among the first to successfully combat the corrosive action of that oil. Years of previous experience in refining Panhandle oil and Mexican production had familiarized the operating personnel with the hazards involved and had emphasized the necessity of careful handling both from the standpoint of safety and service of distillation, fractionating and condensing equipment. The earlier methods employed in connection with corrosive action of West Texas oils at this plant were discussed in THE REFINER AND NATURAL GASOLINE MANUFACTURER in March, 1928, page 94. At that time the plant capacity, for efficient operation was about 3500 barrels per day, and gasoline production was doctor treated to standard specifications without redistillation.

Through rearrangement of equipment and addition of more Winkler & Koch bubble towers the daily charging capacity was increased to 4400 barrels—this being actual runs and not rated capacity. At the same time one of the larger shell stills was taken out of the former line of crude flow and converted into a redistillation unit which can handle pressure distillate at the rate of 1500 barrels daily. Through the use of larger transfer lines, and installation of additional fractionating equipment of modern type, the crude charging balance for even better efficiency than previously, was raised 1000 barrels per day, notwithstanding the loss of one still in the battery which was converted to a rerun unit. Naturally, lower process costs per barrel were secured through the increase in balanced capacity. The plant is a striking example of efficiency and economy procurable through the redesign of old shell still equipment in conjunction with modern fractionation columns.



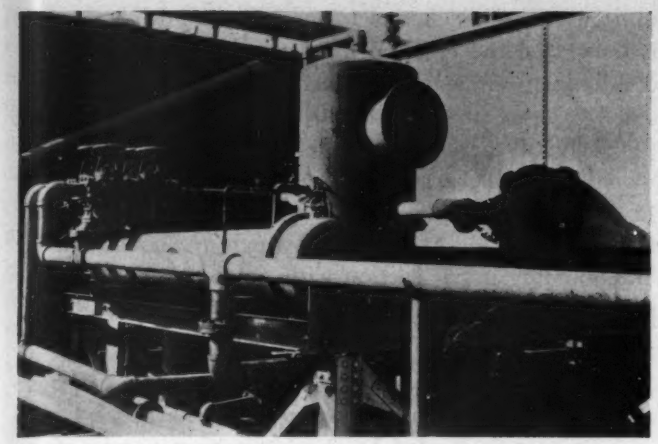
Skimming department of Chalmette Petroleum Corporation refinery at New Orleans, recently redesigned and increasing capacity to 4500 barrels.

CRUDE FLOW

The plant is now processing crude from Winkler County, which is received by tanker at the plant site on the east bank of the Mississippi River. The crude averages 29 A. P. I. gravity with an average gasoline yield of 25 per cent.

The cool crude is charged by a steam driven Worthington duplex pump through five-tube type heat exchangers where it is preheated to 250°F. It is then conducted to the lower section of the bubble tower working in conjunction with shell still No. 1. The crude drains into the still through a six-inch line from the bottom of the tower.

A proportionate pump of Hills-McCanna type working off the driving arm of the crude pump takes suction



Combination recycle stock accumulator and water separator, with gasoline after-cooler. Gasoline recycled over tower is drawn from this tank.

on one of two drums of 13 Be. caustic and discharges the alkaline solution into the crude stream at the point where it enters the side of the bubble tower. The Chalmette practice of charging caustic with the crude has extended over a period of 2½ years and no difficulty has been experienced due to caustic accumulation or embrittlement of shell still bottoms, and the like. Proof of the effectiveness of this practice is indicated by the fact that corrosion of equipment is seemingly eliminated. During the past two or three years the original American cast iron pipe comprising the four-inch manifold type condenser coil has given uninterrupted service. In the separatory lower section of the bubble column, oil transfer lines and vapor lines there is little evidence of corrosion.

Vapors from No. 1 shell still are fractionated in the first bubble tower, while the partially denuded crude is transferred through a six-inch line by gravity flow into No. 2 shell still. These stills are the conventional 10 feet by 30 feet size. An additional stream of gasoline is removed through the bubble tower working in conjunction with No. 2 still. All the bubble towers at this plant are accurately controlled as to top temperatures by means of Tagliabue and Foxboro automatic recording temperature control instruments. The trim stock employed for recycling is circulated through the upper tray of the towers by Westco-Chippewa centrifugal pumps, five of which work on the crude plant bubble towers, and one is used in connection with the rerun still.

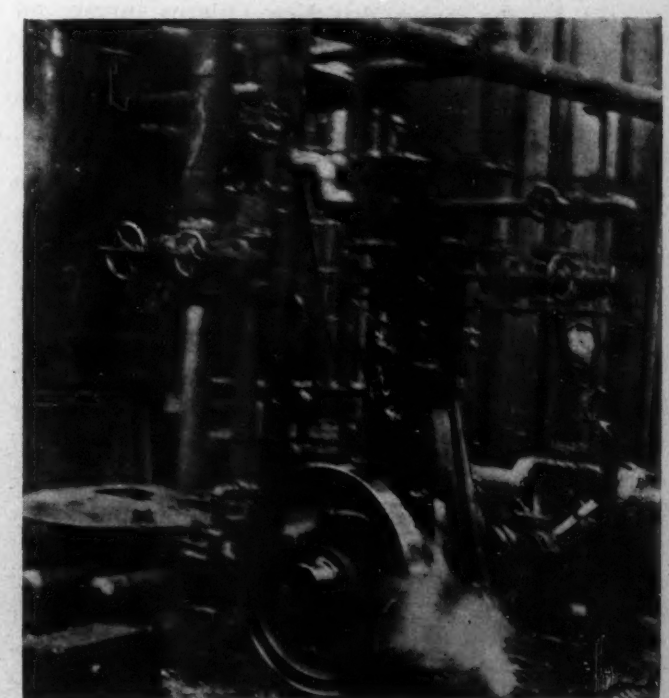
Crude gravitates into the third distilling unit—which consists of two small shell stills both yielding their vapors to a common bubble tower. A slightly higher temperature is held in the second of the two stills which act as one retort, which is sufficient to cause continued flow of the crude. At this point the oil temperature has reached about 500°F. The two stills working as one remove the last of the gasoline cut. Thus the three towers are fractionating vapors from four stills and the heat exchangers. The gasoline streams are condensed separately and are so handled in the receiving house, although they are blended later.

The partially topped crude is pumped from the last stills by means of a Kinney pump driven by a Troy steam engine, which unit is assembled for operation just back of the stills. The small unit is handling hot topped crude at the rate of about 3400 barrels daily, since the original charge of 4400 barrels has yielded 25 per cent, or 1000 barrels of straight run gasoline in the processing up to this point.

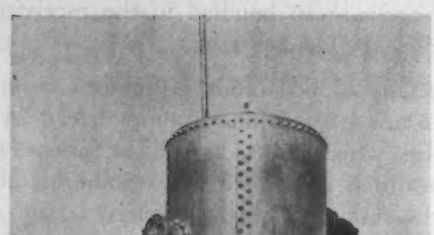
GAS OIL PRODUCTION

The topped crude handled by the Kinney pump is discharged into the fourth bubble tower through which it descends to flow into the next still of the battery through the back trap line. Vapors from this still rise countercurrent to the descending topped crude and the still is operated at sufficient temperature to vaporize a gas oil cut, and at the same time to remove a naphtha fraction of 450 end point over head from the bubble tower. The gas oil is taken from the side of the tower and into a smaller column termed a stripper. A jet of steam removes all of the lighter vapors back into the side of the bubble tower and the gas oil is removed as bottoms from the stripper section. This gas oil has a live market in the New Orleans district and for that reason there are several grades prepared at the Chalmette plant. There is a brisk market in this area for a light and heavy grade of furnace oil, a regular gas oil market and an ever growing Diesel engine fuel market.

In the sixth still the crude is heated to 600°F. and more gas oil is produced. Part of the gas oil production



Steam engine driven pump handling hot oil from third still to next tower in series at the rate of 3400 barrels daily.



Caustic injected into gasoline run down line and the washed gasoline are separated in this drum. Caustic is then circulated back into the run down line.

of the stripper section just mentioned is employed to wash or trim the last bubble tower in the series. In the gas oil bubble tower the vapors are fractionated into two streams. A light gas oil is taken overhead and a heavy gas oil removed from the lower portion of the tower. Much of the lighter gas oil fractions are doctor treated for the reason that New Orleans furnace oil users demand a product of good color, sweet, and low in sulphur.

NOVEL EXCHANGE SYSTEM

The residuum from the last still is taken direct to the cracking unit at 16 to 18° A. P. I. The residuum from the cracking unit is taken under pressure over to the skimming plant exchanger system. Crude flowing through the five exchangers is preheated by the hot residuum leaving the cracking unit to 250°F. Since the pressure plant residuum is flowing through the exchanger countercurrent to the crude flow at somewhat higher pressure than the crude itself there is no danger of ruining the flash point of the fuel oil in the event of leaks developing in the exchanger system. The exchangers are so manifolded that any one of them can be removed temporarily from service for repairs without interrupting the operation of the refinery. There are not many instances where outflowing residuum used for heating incoming crude can be employed at higher pressures than the crude oil entering the system but where such is possible the practice has much to commend it.

PRESSURE DISTILLATE RERUN

Through the utilization of an old shell still 7 x 27 feet in dimensions which was formerly in the original crude battery, and the erection of a new bubble tower, a redistillation unit was assembled when the company decided to erect and operate its cracking unit. Inside of the shell still there was installed 20 six-inch return tubes through which the hot flue gases pass after leaving the fire box and enroute to the stack. The bubble tower consists of 13 decks, seven of which are housed in the fractionating upper section with six decks placed in the stripping section. The tower has overall dimensions of 7 x 63 feet.

Pressure distillate is charged to the unit first through a Griscom-Russell section where the charged oil is to some extent preheated by the hot vapors passing from the tower to the Sterling condenser sections. From this point the pressure distillate passes to the top of the tower and is conducted through a circular coil inside the tower, made of 2½-inch pipe. The outlet of this preheating coil is located just above the seventh bubble tray in the tower.

In its passage downward through the tower over the six stripping decks the pressure distillate is practically denuded of all its gasoline content. Samples taken from the still and from the trap back line leading from tower to still have very little difference in characteristics. The tower top temperature is maintained constant at sufficient heat to yield a 395°F. end point gasoline by means of a Tagliabue temperature recorder controller governing the operation of the electrically driven Westco-Chippewa centrifugal trim pump. Bottoms from the tower have an initial boiling point of 428°F. They make an excellent furnace oil or gas oil.

Gasoline overhead from the bubble tower passes first through the Griscom-Russell vapor-liquid exchange and then through the Sterling condenser sections where the temperature is reduced to 140°F. Leaving the condenser warm the water is quickly settled out in a small drum provided for this purpose and for the accumulation of gasoline for use as reflux media. The water is removed automatically by means of a Fisher liquid level controller. The small trim pump takes suction on the combination water trap and accumulator and charges the warm gasoline back over the top of the bubble tower.

Passing from the separator-accumulator device the gasoline is conducted through a second Griscom-Russell section where it is cooled with water to 85 to 90°F. before it goes to the receiving house. Mississippi River water is employed for cooling purposes and even during summer months it is seldom warmer than 85°F.

Corrosion of equipment in the rerun system is combated by means of ammonia injection. The steel bottles of ammonia are placed upright near the bottom of the column and small lines lead upward a few feet to a point in the trap back line just as it leaves the bottom of the tower conducting the pressure distillate bottoms to the still. It is said that part of the ammonia vapor

passes upward into the tower to neutralize the acidity of the oil vapors and part of the ammonia passes into the still with the bottoms. This is an unusual application of ammonia as a neutralizing agent for the whole body of oil charged, although it is sometimes similarly employed, being charged to still in the crude and at the crude pump. High temperatures usually serve to retard the effectiveness of ammonia under such conditions but in this instance the practice is apparently effective, as there is no indication of corrosion of equipment. Further, since it is essential that Diesel fuels be positively neutral, and since this product is often marketed as such to ships that bunker at the company's terminal nearby, it is certainly economical to neutralize the product at the still rather than having to do it later in the agitator.

HYDROGEN SULPHIDE FROM STREAMS

As previously mentioned the first three gasoline streams constituting 25 per cent of the crude charged, when handled through the receiving house, are blended into one stream and converged into a single six-inch run down line. Running inside of this line for a distance of 40 feet there is a one-inch line which is finely perforated at the sides. Thirteen degree caustic is circulated through this one-inch line at a pressure of about 75 pounds. As the gasoline and alkaline solution flow together through the remainder of the run down line they pass into a large accumulator entering at the bottom. In this manner intimate contact between gasoline and alkali is secured in the run down line and in addition the gasoline must pass upward through a constant level of caustic in the accumulator or separator tank. It is well to mention that the three gasoline streams are completely dewatered before they enter the receiving house. The gasoline overflows from a higher level in the separator and passes into run down storage. This practice assures the removal of practically all of the hydrogen sulphide in the gasoline while it is yet warm and before any reaction between the two can set in. It also eliminates the necessity of a caustic wash in the treating system prior to doctor treatment.

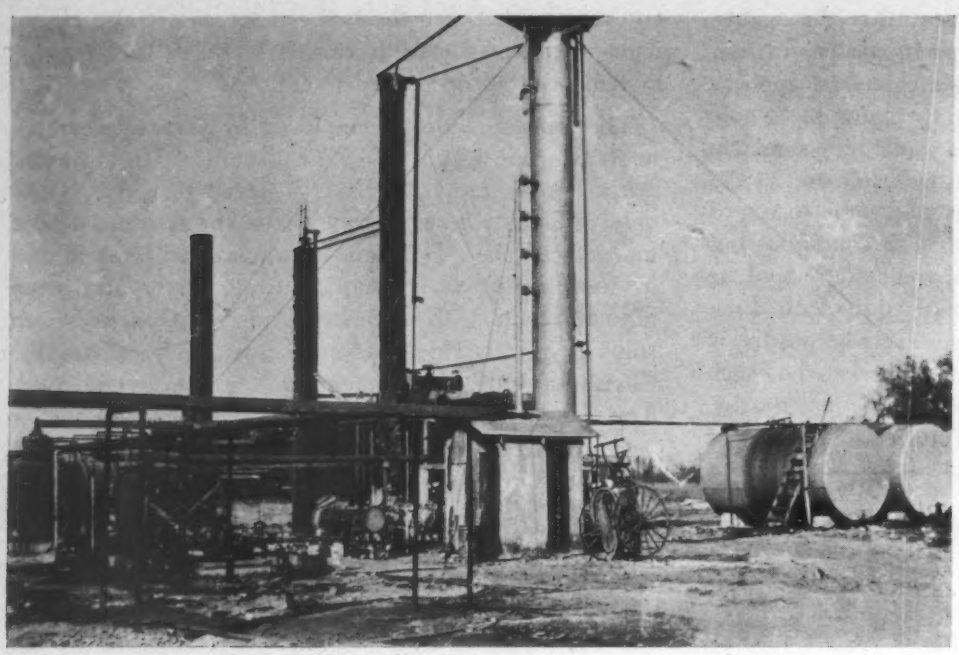
This same practice is employed by several other refiners working with West Texas crude but different methods are employed. It is believed that this is the only instance where the run down line is utilized as a treating chamber. It has the advantage of a reduced cost of installation, as well as assuring longer and more intimate contact. The practice of removing hydrogen sulphide quickly from both cracked and straight run distillates has proven of much value wherever employed. The caustic is circulated from the accumulator or separator by means of the steam driven pump and back into the run down line. Additional alkaline solution is added periodically to keep it at constant strength. This innovation, as well as the other interesting features mentioned at the Chalmette plant, was designed by E. J. Mary who has been in charge of operations during the past two years. The gasoline produced through the blending of the three streams has an A. P. I. gravity of 56 degrees. The rerun gasoline stream, derived from the distillation of pressure distillate averages 58 A. P. I. gravity. The other products of the plant are a 38 gravity furnace, a 31 gravity light gas oil and a 25 gravity heavy gas oil.

It is estimated that about 60 per cent of the gasoline produced is loaded in tankers at the company's terminal adjacent to the plant. About 75 per cent of the fuel oil production is shipped in the same manner, and 80 per cent of the surplus gas oil is loaded in Diesel oil burning ships bunkering at the company loading terminal.

ACID RECLAMATION

Prior to installation of the cracking unit and the continuous treating plant for acid treatment of pressure distillate the operators were not concerned with the

Acid concentrating plant which pays its way through the provision of acid free tar used for firing boilers.



Stabilizing system which is used to stabilize natural gasoline and for the preparation of rubber solvent, rosin solvent and cleaner's naphtha.

problem of sludge acid disposal. With the erection of these facilities however, it became necessary to install equipment for the solution of this problem. It was decided therefore to employ an acid reconcentration system by means of which old acid could be reconcentrated and re-used. Acid sludge from the pressure distillate treaters is taken to a kettle where oil is added and steam heat applied. Upon application of heat the acid settles to the bottom and the oil accumulates above it.

The acid is drawn off to a mixer where new acid is added to bring the mix to 66 per cent. This after the old acid has been concentrated to 50 in the mixer. The oil and water mix rising to the top of the first kettle is transferred to a separate tank where it is free of its moisture content. This consists of the tarry sludge and the added oil.

When the weak acid is concentrated to 50 per cent acid there is a surplus over and above that needed for treatment, and this surplus is made oil free and marketed to a nearby fertilizer manufacturer.

All of the tar and oil mix secured in the operation of this small concentrating plant is utilized as fuel under the refinery boilers. In this manner the acid plant pays its way on the refinery yard, in addition to solving the problem of acid sludge disposal, which is a serious one where plants are located in metropolitan industrial districts.

Plant records show that during a recent month there was a total consumption of 300,000 pounds of 66 acid. During that period 113 barrels of heavy gas oil was charged to the acid concentrating plant which is used to help bring about the separation of weak acid and tarry sludge in the first kettle. During this same period the boiler house received a total of 1261 barrels of fuel oil from the acid plant, or an average of 42 barrels per day. Deducting the amount of gas oil from the amount of total oil sent to the boiler house there is a remainder of 1148 barrels of tar recovered from the acid sludge from the treating system and utilized as fuel oil under the power house boilers. This tar is acid free. The sale of surplus 50 per cent acid brings in a certain revenue, but probably the chief value of such an installation lies in the elimination of the acid disposal problem at plants where acid is not employed in sufficient quantity to warrant the erection of more costly reclamation plants.

STABILIZING NATURAL GASOLINE

Chalmette Petroleum Corporation for some time has been taking advantage of a market in its territory for rubber solvent, cleaner's naphtha, and rosin solvents used by the turpentine mills in the southern states. In addition the same unit is employed to stabilize grade AA natural gasoline for use in blending its gasoline to 64-66 A. P. I.

A complete Braun unit consisting of fractionating columns, exchangers and preheaters was installed for this work. When natural gasoline is cheap the unit is employed in stabilization of this product. Blending the stabilized gasoline with its skimming and cracking plant production requires the use of 40 per cent natural gasoline when stabilized. It is necessary that this product be stabilized in order that the specified recovery of 96.5 per cent by Engler distillation test may be secured, and at the same time meet the desired gravity range of 64/66 A. P. I. Some stabilized natural gasoline is also marketed. When the unit is doing this type of work the second column is employed as an absorber through which the lighter vapors are passed to be absorbed by light gas oil. The enriched oil is then taken to the refinery and injected into one of the gasoline bubble towers which practice reduces the loss to a minimum.

At other times sweet naphtha is secured of about 415 end point and charged to the stabilizing unit. Under this method all three of the towers are employed. The first tower yields a fraction of rubber solvent overhead, the product from the second column is marketed as rosin solvent, while the third tower yields cleaner's naphtha and the bottoms from this tower are accumulated as kerosene. The utilization of this equipment is governed to a great extent by the condition of the market, which so far, has been favorable to its operation. A number of other South Louisiana refineries are also equipped with like facilities which can also be utilized as vapor recovery units, extracting gasoline from tank and receiving house vapors.

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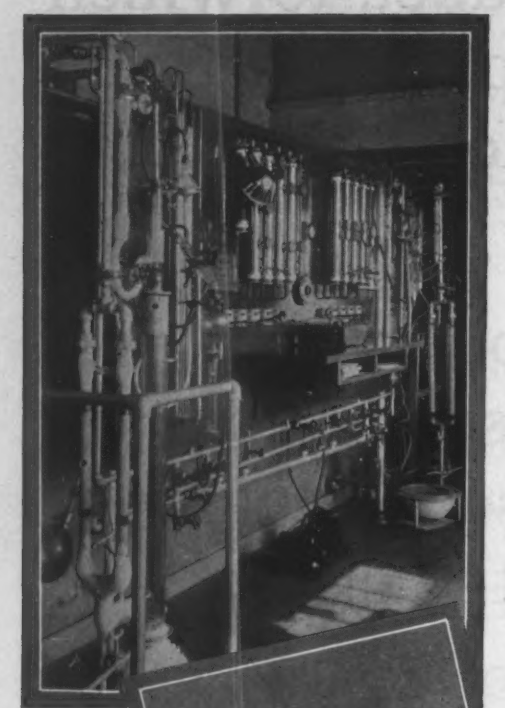

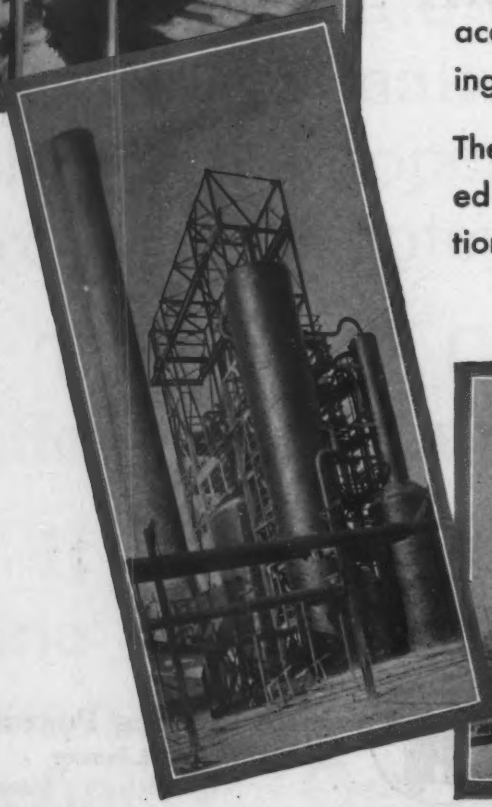

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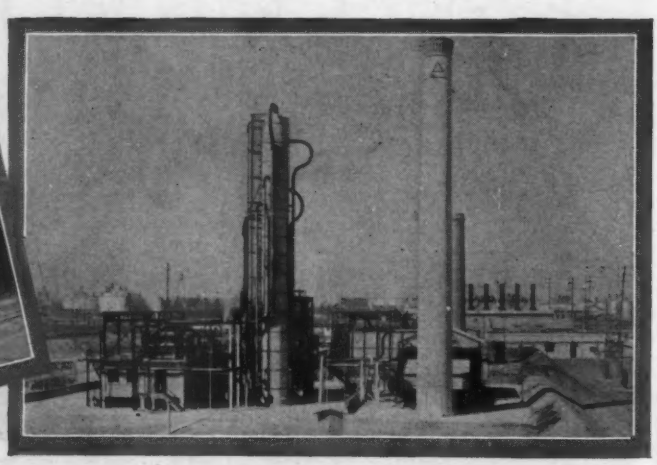

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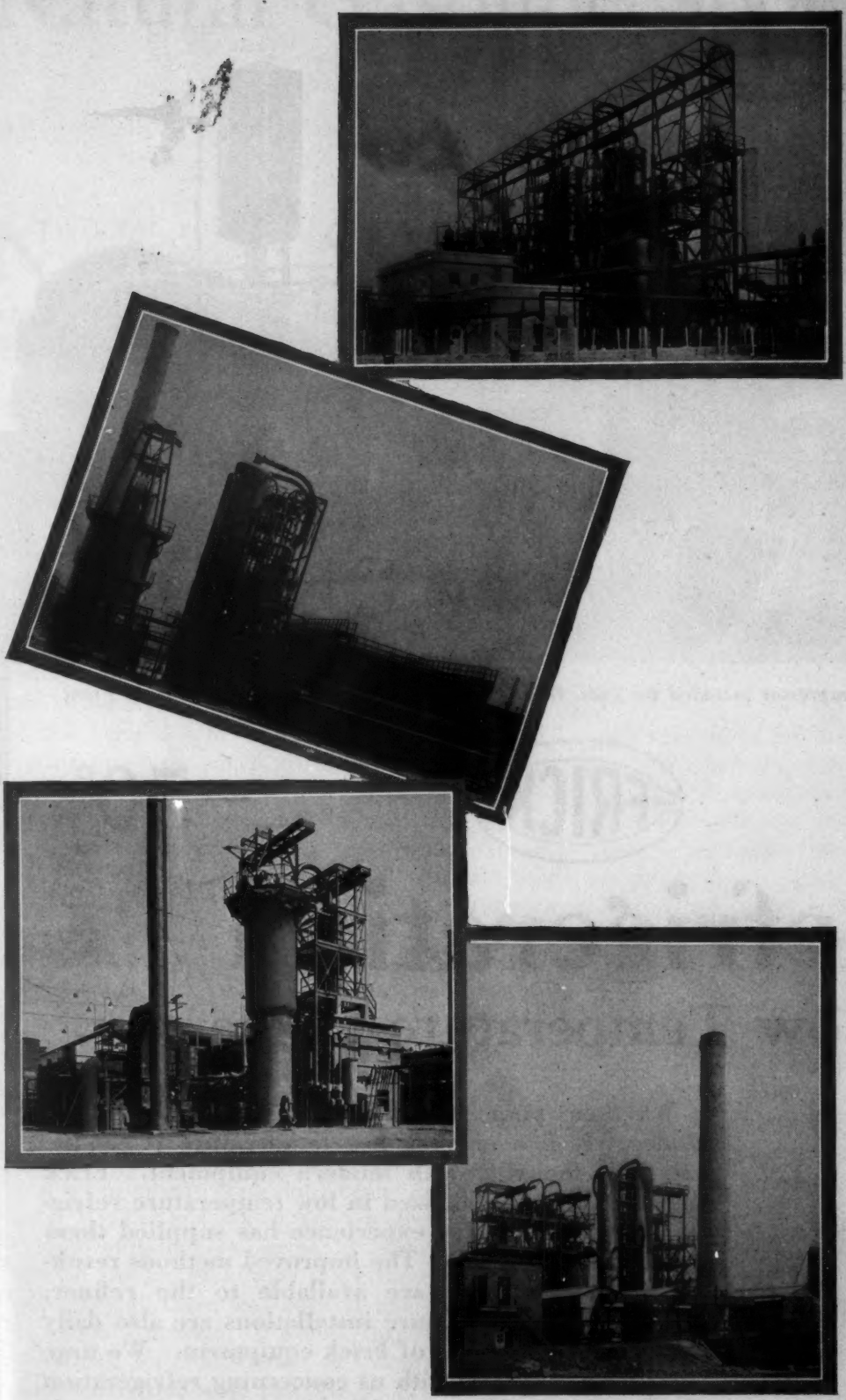

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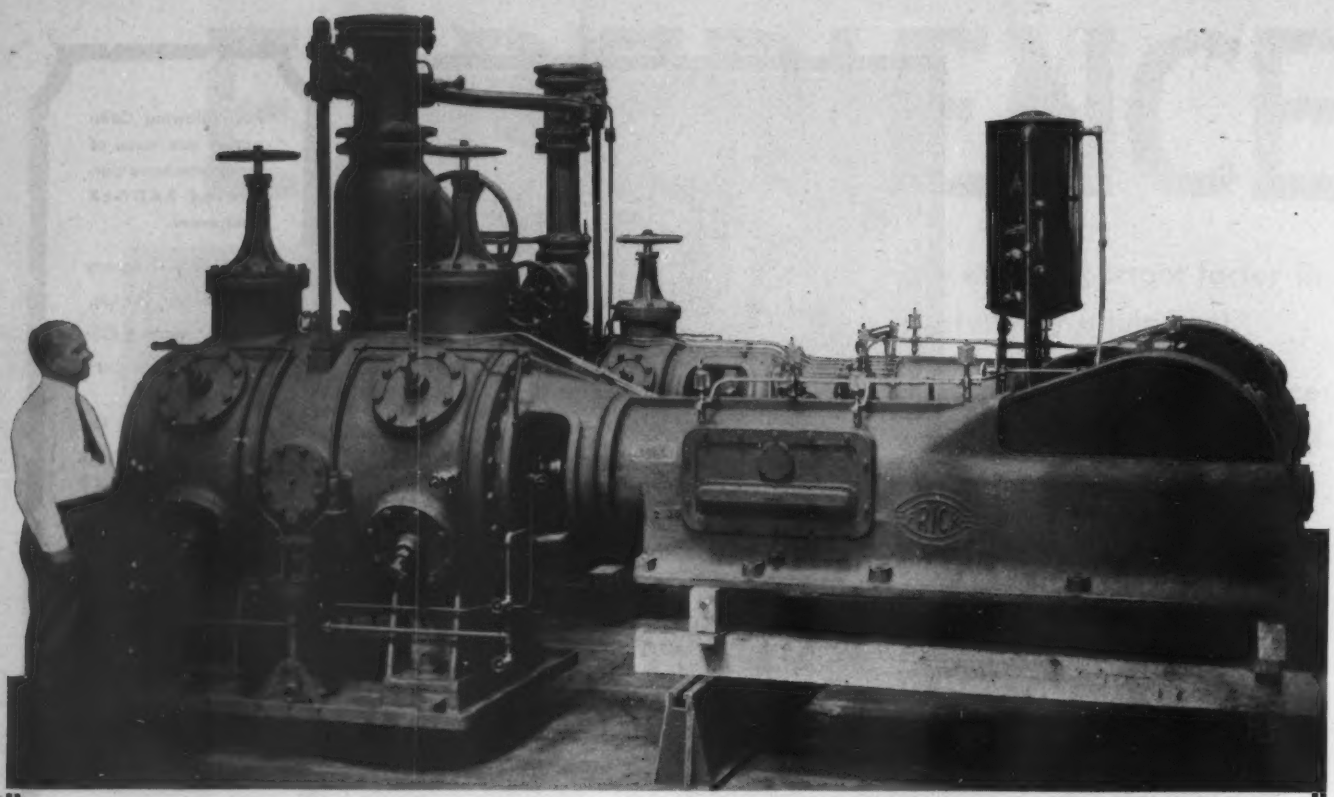

Two-stage Ammonia Compressor installed by Tide Water Oil Company at their Bayonne, N. J. Plant

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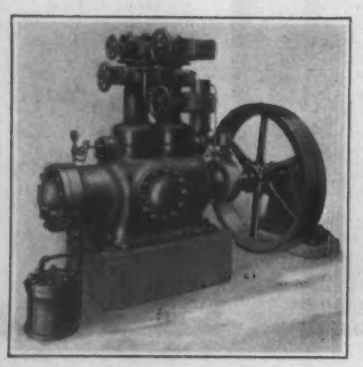

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By S. S. SMITH
Shell Petroleum Corporation

S. S. SMITH of Shell Petroleum Corporation was commissioned by the Natural Gasoline Association of America to present a paper before the convention of the Western Petroleum Refiners Association at its meeting in Shreveport, dealing with specifications for natural gasoline. Mr. Smith stated that at the time of this assignment it was expected that the Natural Gasoline Association would have finished its research into new specifications to cover natural gasolines. This work, however, was not completed in time and therefore his paper was incomplete. Some progress was reported however, and that progress constitutes the substance of this paper.

NATURAL gasoline, as you know, came into existence as an accidental by-product in the production of oil and gas. At that time its only specification was the term casinghead gasoline of some particular gravity. Its early uses were principally for blending against gravity specifications, although large amounts were used directly as motor fuels in Eastern states. It was inherently a product which could be used as a motor fuel, this being due to the inefficiency of the manufacturing processes which produced it, and the comparatively low volatility of the product produced. Then it was a popular motor fuel, although we did not know what particular characteristics made it successful. Now we know that its successful use was caused by its high anti-knock quality, its extreme volatility which made for ease of starting and that same volatility which made for flexibility or snap. We know too, that since it was the product of inefficient manufacturing processes, the vapor pressure was low enough to not cause trouble due to gas lock of kindred troubles. This was the more possible because in those days we had no hot-spot manifold and high temperature jacketed carburetors.

Later in the history of the business, when absorption gasoline plants came into being in Oklahoma and the Mid-Continent field, and compression plants had their efficiency improved by somewhat more intelligent design, gravity as a specification became insufficient and there was born at this time a new specification—recovery. We find, therefore, that in July of 1921, the Association of Natural Gasoline Manufacturers published nine grades of gasoline designated alphabetically. In these specifications, the important points of consideration were — gravity, vapor tension, recovery and initial boiling point. In December of 1922 the number of grades were reduced to A, B, C and D. These had recoveries of 90,85 and 78 with gravities ranging from 72 up to 92.

LATER CHANGES

Improved plant design becoming a more and more important factor, we introduced a change in the method of distillation which provided for a 32-36 degree bath on the condenser and receiver. This occurred in 1924. Other specifications remained approximately the same, although the grades were increased to five, A, AA, B, BB and C. These grades were designed to reflect the difference in gravity and recovery which existed with bearing types of plants and in production from fields producing oil of varying gravity. Again in 1927 we find that the Association published five grades which reflected no change over the previous grades of 1924, except to raise the gravity on grade C to a maximum of 92 Baume. These then, are as follows: Grade A, 72-79.9 gravity with recovery in excess of 90; Grade AA, 80-87.9 gravity with a recovery of 90; Grade B, 76-83.9 gravity with a recovery of not less than 85; Grade BB, 84-92 gravity with a recovery of not less than 85; Grade C, 80-92 gravity with a recovery of not less than 78. Reviewing the picture, we find gravity specifications raised in 1924, at about the time stabilization or rectification of natural gasoline became a matter of interest to the industry, when the absorption process became current, and thoroughly efficient. The subsequent change in 1927 was to permit the inclusion of slightly higher gravity products in grade C, further reflection of increased efficiency of plant extraction from field gases. This picture exists today. We have five grades, two of which are especially designed to take care of high gravity, high recovery products produced by proper rectification of natural gasoline in the field.

Since the time of the last change of specification, there have come various changes in the industry which are disquieting to manufacturers of natural gasoline and to refiners. It has been necessary to revise our ideas as to what constitutes profitable operation. It has been necessary for us to learn to better economize in operation and manufacture. It

has become necessary for you to derive more gallons of gasoline per barrel of oil, produced and delivered at your refinery gate. We now find ourselves manufacturing a product meriting consumption but we find consumption falling far short of production. We have come to assume therefore, that existing specifications do not encourage fullest use of our product. And with this thought in mind our Association has embarked on new research into specifications which may encourage such use.

VALUE OF CONSTITUENTS

While you know, perhaps better than I, the individual constituents which make up natural gasoline, let us review them and get clearly in mind the merits of each constituent and the part it plays in the finished natural gasoline as you receive it. The range of products included in natural gasoline are the hydrocarbons, propane to octane, the chemical series C^3H^8 to C^8H^{18}, and in the Mid-Continent at least, all of the normal saturated compounds and their isomers, together with some of the cyclic compounds in this series. Of the series, we can dismiss from consideration here, the three octane, heptane and hexane as being of value primarily as solvents or retaining agents for pentane, butane and propane. The three products, octane, heptane and hexane you already have in refinery stock in large quantity. Our sale of such products to you is incidental to the sale of volatility represented by pentane, butane and propane. Pentane has a boiling point of 97°F. and a vapor pressure at 100° of approximately one pound; butane has a boiling point of 32°F. and a vapor pressure of approximately 37 pounds; propane, the lightest in the series, has a boiling point of —44°F. and a vapor pressure of approximately 180 pounds. Considered singly and separately, propane is a product which can be retained in high pressure cylinders at normal atmospheric pressure; butane can be retained in rather low pressure cylinders but requires pressure vessels; pentane can be carried around in a bucket like water. Hexane, heptane and octane must be vigorously heated to boil, and are entirely stable at normal temperature and pressure.

As you know, these six products are extracted from natural gas by absorption or compression methods, which remove all of the octane, heptane and hexane, most of the pentane, part of the butane and a small amount of the propane, and the measure of percentage of the recovered products, pentane, butane and propane, is a measure of the efficiency of plant extraction. If we could conceive that the market would absorb all of the volatility which the natural gasoline manufacturer could build into his product, then the normal procedure would be to run the plant extraction efficiency as high as possible, store the product derived from such extraction in high pressure tankage, ship in high pressure tank cars and let the refiner blend under pressure. This would enable the refiner to make the maximum gallonage of finished motor fuel from a minimum amount of crude oil.

Since the market picture is different, it behooves us, to look at the picture judiciously and decide that which is economic and to the best advantage of both refiner and manufacturer. In the proceding outline of characteristics of individual constituents, it would appear on casual inspection that any refiner would desire a butane-free natural gasoline. That might perhaps be true, if the specifications of individual products as given were the sole and only specifications and qualities which these products possess. However, they have certain other and useful characteristics. Heptanes, as you know, is used as a base standard for anti-knock specifications, it having the lowest benzol equivalent of any of the normal volatile hydrocarbons. Speaking in terms of compression ratios, at which it can be operated without knocking, we find heptane will stand 3.75 compression ratio. Hexane, the next in the series, will stand 5.8 compression ratio; pentane, 5.85 compression ratio; butane, 7 compression ratios and propane 7.5 compression ratios. Speaking in terms of benzol equivalent, all of these except heptane are well above 50 per cent benzol. Since most motor fuels on the market have benzol equivalent not much in excess of 35 per cent, it can easily be seen that the blending value of natural gasoline against the detonant qualities of normal gasoline, is excellent.

VOLATILITY

Its chief value, however, rests in its volatility. On this score, propane, butane and pentane, all having volatilities of 100 per cent at 100°, are excellent for the purpose of increasing startability, acceleration, etc., of your finished motor fuels. If we consider the blending value of each individual constituent in natural gasoline, and endeavor to work with these values, the blending operation becomes a complex one. Fortunately, it is not nearly so difficult. The prospect of analytical specifications for natural gasoline worried all manufacturers for some time. It is my understanding that there were even some contracts closed on the basis of analytical specifications, that is, that natural gasolines were to have certain percentages of pentane, butane or propane. This bugbear no longer exists. Intelligent natural gasoline manufacturers and refiners generally, now concede that there is no necessity for individual component specifications, but that the measure of usefulness of natural gasoline as finished blending stock, rests in some effective and proper measure on its volatility.

The work which the Association has done during the last six months on this subject, points very

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strongly to the adoption of some such specification. Most of you will recall that Oberfell and Alden of the Phillips Petroleum Company last year published an article covering the analysis of natural gasoline by A. S. T. M. distillation methods, and those of you who recall this work will undoubtedly agree that if you check this method against actual analyses, it is accurate within rather close limits. A year's use of the method among natural gasoline manufacturers has only necessitated correction of the curve at extremities, that is at the low and high percentage butane and pentane points.

This indicates that it is easily possible to evaluate gasoline on its composition by means of A. S. T. M. distillation. Since this fits into Dr. Bridgeman's, Dr. Brown's and the Association's work, such a valuation must be sound in principle and practice. The old grades of gasoline, A, AA, B, BB and C, indicate practically nothing of composition and little of the blending value of such products. It is possible for instance, under AA specification to sell products having a range of butane contest from 15 to 35 per cent and pentane content from perhaps 15 to at least 50 per cent. Since most of the gasoline made and sold is AA specification, it can easily be seen that the buyer of AA grade gasoline, on open spot market, is likely to get almost any kind of product. If we concede that all manufacturers will crowd the top limit of specifications then the chances are that when the refiner buys AA gasoline, he will receive a product having little over 90 recovery and close to 87.9 gravity. Still when he receives such specification, there is possibly a wide range of composition.

RECOVERY

Recovery is principally a function of vapor pressure, although vapor pressure does not necessarily define the composition. This statement means of course that composition of gasolines having the same vapor pressure may vary widely. It also follows that vapor pressure is not necessarily indicative of blending value, although in an efficiently operated plant with proper rectification, vapor pressure is closely analogous to utility of product. We may express it this way, that vapor pressure is a useful negative specification, although not necessarily a useful positive specification.

We have said before that volatility of natural gasoline is its chief asset. If we concede that vapor pressure is not necessarily a measure of volatility, then some other measure becomes necessary. Recent government specifications covering finished motor fuels, both for aviation and motor use, stress the importance of the 10 per cent or the 122° point. Natural gasoline is chiefly useful as affecting these points. Vapor pressure and anti-knock quality of the finished motor fuel can be calculated in advance of blending.

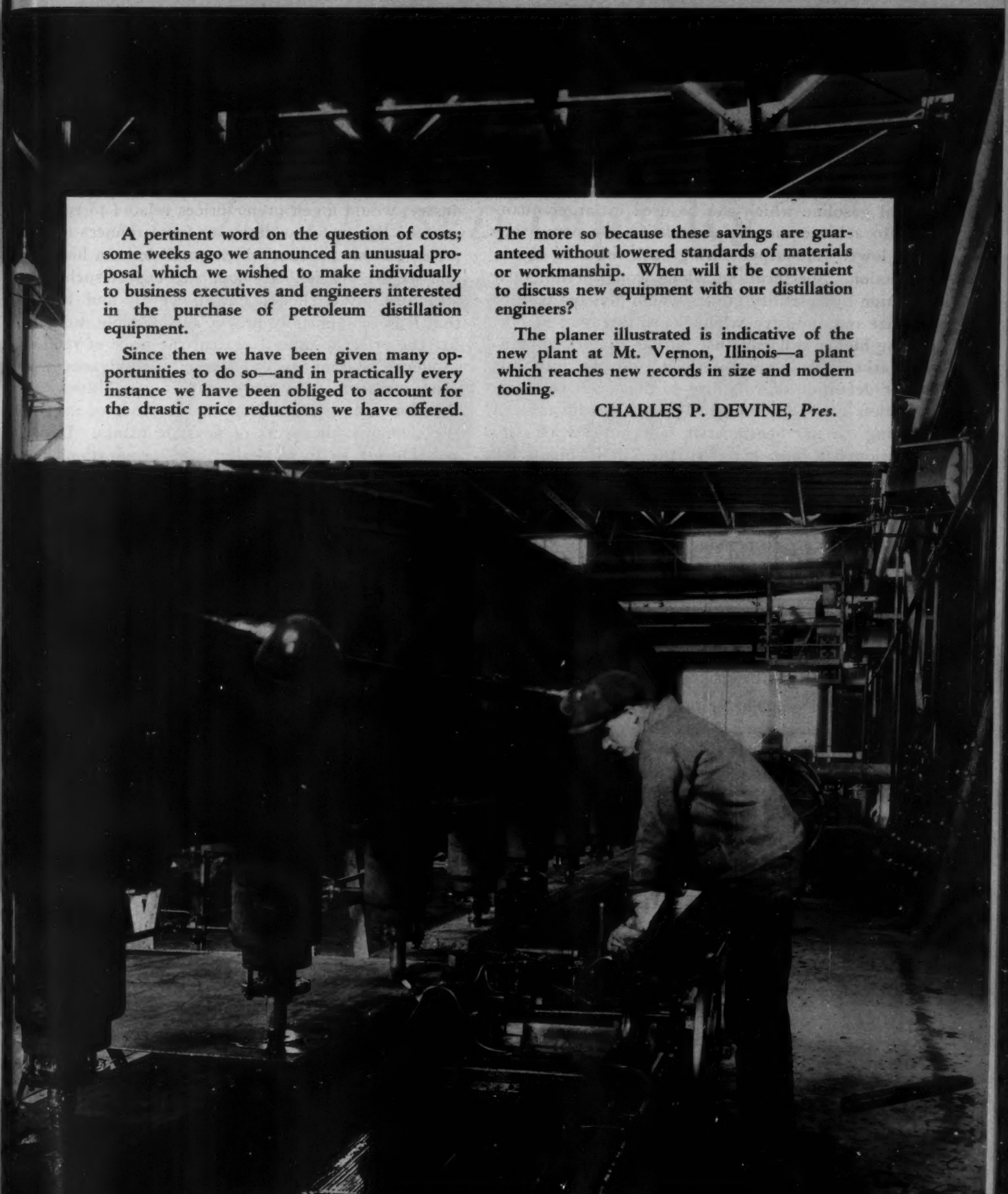
As far as I know, no one yet has laid down effective rules for tying into the finished motor fuel specifications, the boiling points of natural gasoline. Experiments which the Association is now carrying on, however, indicate that it will be possible to blend to a fixed or predetermined 122° point, or to a fixed or predetermined 10 per cent distillation temperature, and prophesy with extreme accuracy the finished result. When this work is completed and released, we will have placed in the hands of all refineries, information which will enable them to use, with least possible effort, the largest amount of natural gasoline economically possible.

It is a point for discussion of course, but after experimentally using a number of different fuels this winter in an automobile of standard make, which has no unusual characteristics of its own, I am thoroughly convinced that few refiners are yet using enough natural gasoline. By this I mean that most gasolines are not sufficiently volatile to give good motor performance in cold weather; I mean also, that they are not sufficiently volatile to start on cold mornings; I mean also that they are loggy, because they do not have sufficient volatility to give quick acceleration; I mean also that their anti-knock qualities can be improved by the use of more natural gasoline.

I was told just before leaving Tulsa for Shreveport, by one prominent Mid-Continent refinery chemist, that I was mistaken in this point of view, and that most refineries knew more about the use of natural gasoline than I had ever dreamed, and used it in far larger percentage than I suspected. I do not advocate excessive use of natural. I do advocate however, that you use quantities of natural which will permit you to build into your gasoline vapor pressures as high as 8-10 pounds Reid. I would place as a possible limit on the use of natural gasoline, butane composition of 6-8 per cent in finished product. I would advocate always for motor performance that natural be used up to any point which will not give trouble due to vapor lock. While this may already be done by refiners, I am firmly convinced that if so, some of you are not blending natural in such form that desired qualities can remain in the product. In other words, you are blending to vapor pressure rather than to volatility. I know that a great many motor fuels which I have used this last winter have certainly not had sufficient volatility to make decent performance, and that this condition can easily and cheaply be remedied by the use of natural.

ECONOMIC BENEFITS

It is our opinion in the National Gasoline Association, that if we can provide specifications which will decrease the volatility of natural gasoline during times of excess production, and will increase the volatility of natural gasoline during times of shortage of production, which although remote are possible, then the economic benefit to you in the refinery and



A pertinent word on the question of costs; some weeks ago we announced an unusual proposal which we wished to make individually to business executives and engineers interested in the purchase of petroleum distillation equipment.

Since then we have been given many opportunities to do so—and in practically every instance we have been obliged to account for the drastic price reductions we have offered. The more so because these savings are guaranteed without lowered standards of materials or workmanship. When will it be convenient to discuss new equipment with our distillation engineers?

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us in the natural gasoline business, will be two-fold. It will first provide you at low cost, large blending values during times of shortage of production, while permitting us the highest possible production during such time. It will also permit during times of excess production, the manufacture of lower volatile natural gasoline which can be used in larger quantities to achieve the same results, while permitting us to lower our output during such times of excess production. Specifications which would permit such reduction by volatility grades would perhaps tend to stabilize our industry while benefitting you in permitting higher gallonage use during low priced natural market. Such specifications, too, fit into our proper definition of volatility so that such volatility definition can be intelligently used in advance of blending. In our Specification Committee work, consideration has been given to the 100°F. point, the 122°F. or 50° centigrade point and the 140°F. point. Difference in composition of additive percentages of butane and pentane is best reflected by the 122°F. point. Difference in pentane composition is best reflected by the 140° point.. Difference in butane composition is best reflected by the 100° point. Difference in propane composition is best reflected by the vapor pressure. Our work does not yet indicate with certainty the point which best reflects the actual blending utility of the gasoline.

The natural gasoline industry is in the peculiar position of being the sole part of the oil industry which must continue to operate regardless of the market. The production from oil wells can be discontinued when they became unprofitable, or such production can be stored during times of unprofitable operation; refineries can, in times of duress, cease to manufacture any product, or they can curtail thruput while storing crude, or by not buying crude; the natural gasoline industry, in contrast to the oil producing and refining industry, is compelled to process its raw material when produced, and the production of such raw material is in the control of oil operators, not the natural gasoline manufacturers, therefore, we must continue to manufacture products or give up investment in plants. The only means we have of curtailing production, then, is not by limiting purchase of gas and plant thruput, but by means of rectification, reduction of volatility, vapor pressure and gallonage by wasting the more volatile components of our natural gasoline.

BUILT TO PREVENT WASTE

Our industry is built on the salvage of an otherwise economic waste. The raw material which we buy must be purchased on open contracts which compel us to take or pay for raw material whether we make a profit or not. Our product is sufficiently volatile to require expensive, high pressure storage, therefore it is almost incumbent on us to sell it when manufactured. Our industry therefore finds itself in a most vulnerable position at the hands of economic law. A few cars of distress natural gasoline can force the market below possibility of profitable operation. On the other hand, a slight shortage of natural gasoline can bring the market above that of refinery products. We in the natural gasoline industry, would much prefer prices related to refinery prices. We have no desire to force refiners to pay prices for our product which entail less on his part, and we are not foolish enough to expect such price structure. We should like, however, and believe that it is economically proper and possible, to stabilize the price of natural against the price of refinery products, so that we can compute in advance with some measure of accuracy, market possibilities, and therefore can judge with some measure of success, the economic prospects of possible plants. If it is possible for us to so design our specifications that we can have the hearty support and cooperation of refineries in achieving such an end, then the Association is repaid for its research.

We desire your advice as to what line to pursue. We recently sent out a questionnaire to some 56 refiners, covering their desires in the use of natural gasoline. The response to this questionnaire has been very gratifying, and of immense values to us in the Specification Committee's work. I will very much appreciate personally, any further suggestions you may offer, toward improving either the quality of our products, or the specifications under which said products are sold, and it is for such purpose that the Association has requested me to deliver this paper.

Louisiana-Arkansas Refineries Operating 60 Per Cent

(*Continued from page 74*)

tower type near capacity on Pine Island crude. Its new 2000-barrel capacity Cross cracking unit has been in operation for several months. This is the newest cracking installation in the district and the latest features of modern design were incorporated in its construction.

ARKANSAS ACTIVITIES

About March 1, James B. Berry & Sons Company, Waterloo, Nevada County, Arkansas, shut down temporarily. This asphalt specialties plant is rated at 2000 barrels daily capacity. Houston Oil Company, at Camden, resumed operations around the first of the year, and is now processing about 2500 barrels of crude from the Van field, Van Zandt County, Texas, which is delivered to the refinery in tank cars. Oil is being processed through the new tube still and bubble tower installation. The company has also installed a new pipe still to work in conjunction with its rerun still which formerly operated only on steam. At present refining is con-

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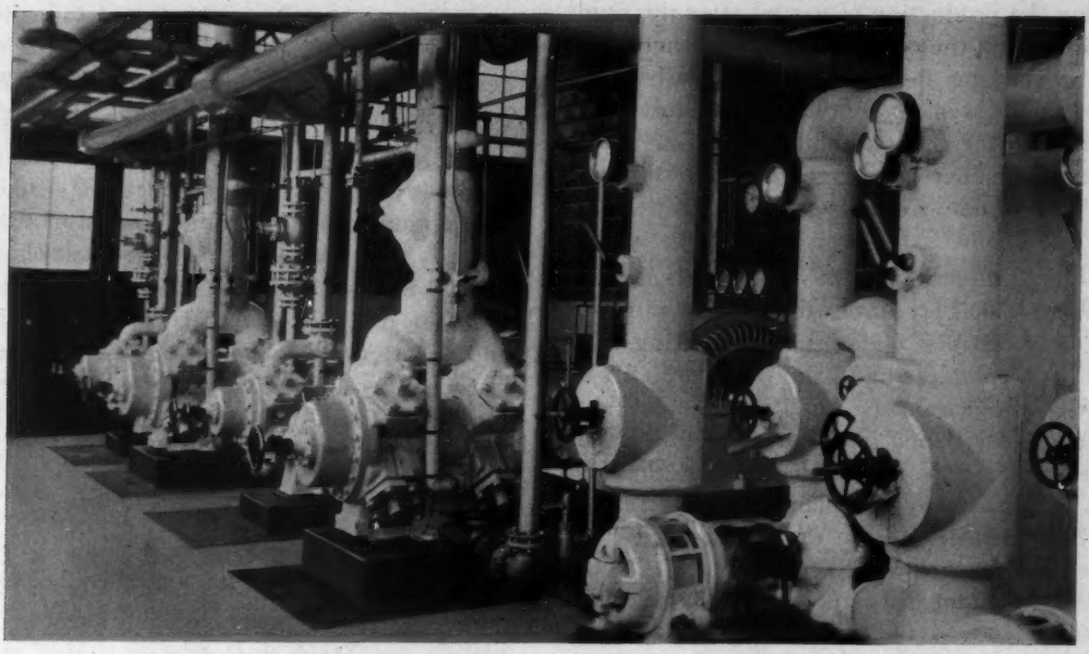

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fined to gasoline and kerosene fractions, with gas oil and fuel oil being stored for cracking stocks when market conditions permit. The cracking department is at present shut down. The Van crude is yielding sweet products from 35 gravity oil at 32/33 per cent recovery of gasoline which requires but a slight caustic wash in the treating department.

At Smackover the H. H. Cross Company has completed the installation of a new pipe still for use in increasing the production of gas oil after the crude has passed through the original battery of shell stills. The plant is running about 2500 barrels daily. The new still is composed of 70 twenty-foot tubes and receives oil from the shellstill battery at about 575°F. Its use effects an increase in gas oil from 14 to 25 per cent. The crude yields from 10 to 12 per cent naphtha.

Simms Oil Company, also at Smackover, is operating at about 2500 barrels per day with a rated capacity of 3000 barrels. The spring painting campaign has been completed and the plant presents its usual spotless appearance. An improvement program is under way which involves changes in facilities similar to those recently completed at the company's Dallas plant. At this plant the pipe still furnace has been rebuilt and the radiant bank of tubes raised five feet, 10 inches higher.

Root Refining Company at El Dorado has installed a new 500-horsepower boiler, and placed Dow type of hot oil pumps on its Dubbs units. In addition they have reversed the flow through the upper two banks of tubes in the Dubbs units and installed cold air fans. With a rated capacity of 10,000 barrels it is operating at 8000 barrels daily. During the past year the company has also installed two new 2500-barrel pipe stills, one of which is the pressure type. Additional steel storage facilities have also been added. The company recently completed the erection of a new gymnasium and athletic club building in cooperation with its employee club members.

At the Lion Oil Refining Company plant a new high pressure tube still has been erecte dand placed in operation during the past year, and a new Southwestern type vapor recovery system. It is also reported that the company contemplates the erection of a new tube still this year. The plant is operating at 8500 barrels daily with a rated capacity of 10,000 barrels. Ouachita Valley Refining Company, a neighboring plant, with rated capacity of 2000-barrels is processing local production at about half capacity.

MacMillan Petroleum Corporation has changed its methods of operation since it was reported in detailed description in this magazine several months ago. The plant is now removing a larger fraction of low cold test lubricating oils under vacuum. A new pipe still has been installed to replace the original installation, and a battery of four shell stills have been installed in which air blown asphalt specialties are manufactured.

The Kettle Creek Refining Company (Imperial Refining Company, Tulsa) with a rated capacity of 6000 barrels is operating at about 3000 barrels. J. L. Farrell, formerly Producers and Refiners Corporation, Parco, Wyoming, is now general superintendent for Imperial Refining Company and affiliated companies, and Gustav Staub, formerly with Marland Oil Company, at Ponca City, Oklahoma, is superintendent of refinery operation at El Dorado.

This district aggregates a total refining capacity of about 52,000 barrels, and is processing around 30,500 barrels of oil daily. The North Louisiana territory has a total capacity of about 48,000 barrels and is processing around 29,500 barrels.

Schultz Process Applied to Hosston Crude

(*Continued from page* 83)

sections the crude is then pressed through one bank of tubes in the furnace and heated to 570°F. At this temperature it is taken to a small tower or separator where all water is evaporated and a stream of gas oil vapor removed. A second pump removes the crude from the bottom of this separator at 525°F. and charges it through the second and third banks of tubes where it is heated to 770°F. and at this temperature it reaches the larger tower for separation of the lubricating oil fraction and the residuum.

Vapors leave the top of the large tower at 640°F. and pass into the sectional Leach fracto-condenser previously mentioned. At this point the lubricating oil fractions are withdrawn from the four sections of the condenser and the gas oil vapors are taken from the top and conducted to condenser coils, and to storage. All four of the lubricating oil distillate streams removed from the bottom of the vertical condenser are combined and run to storage. This material is later subjected to batch still operating under vacuum and the distillate separated in run down storage tanks according to the desires of the operators. Worthington vacuum pumps, 3-stage, size 25 by 25/25 by 18 are used to create the reduced pressure, there being three of these pumps—one for each batch shell still and one for the pipe still. This equipment is also driven by electric motors. All of the run down tanks, the vacuum pumps and certain lines are provided with visible manometers to indicate the state of the vacuum. All of this equipment, and the manifolds on pumping lines, as well as the control room for the plant operator, are centralized in one large corrugated iron building. This building is well ventilated, well lighted, and provided with concrete flooring. It is possibly the only refinery in this country where every one smokes cigarettes, pipes, or whatever is his liking, and any time he wishes, with no danger of fire.

Camden Refinery Operating on Van Sweet Crude

TO the operating personnel of the Houston Oil Company's refinery at Camden, Arkansas, the processing of Van crude from the Van field, Van Zandt County, Texas, comes as a distinct relief, for this sweet crude yields gasoline which is sweet and of stable color wit honly a light caustic wash in the continuous treaters. After some years of refining Smackover and other Arkansas crudes the men on tour at this plant consider it a real pleasure to charge 35 A.P.I. gravity sweet crude to the pipe stills and remove 32/33 per cent of sweet gasoline.

At this time the Camden plant of the Houston Oil Company is confining its crude processing to the removal of a 62° A.P.I. gasoline fraction, a kerosene cut and a gas oil cut. The gasoline and kerosene and part of the fuel oil is being marketed at this time, but the gas oil and some of the fuel oil is being held in storage either for cracking when market conditions are considered right or for later sale as fuel and furnace oils.

At this time the cracking department and the rerun distillation pipe still and bubble tower units are not operating. The crude is skimmed in the company's new Kellogg tube still and fractionating column unit which was operated last year from May to October, and was then shut down with the remainder of the plant until January 15, 1930. The operation has alternated between Van crude and Rainbow (Arkansas) crude during the past three months.

The distillation unit incorporates the latest features of design, operation and control, and consists of a large four-inch tube still having the banks of tubes, a large combination separatory and fractionating column, which is provided with steam flashing stripper sections and allows the removal of three side streams. There are 20 bubble trays in the column above the separator section.

New tube still, fractionating column, with stripper section used by the Houston Oil Company at Camden, Arkansas, for the distillation of Van crude from Van Zandt County, Texas.

Crude is charged to the unit through an exchanger located at the top of the tower where some of the heat is removed from the vapors leaving the column, and through a second exchanger where the outgoing residual oil is partially cooled by the incoming crude. After this preheating the crude passes through the three tube banks progressively, where it is heated to sufficient temperature to cause the vaporization of the gasoline, kerosene and gas oil fractions. The still is fired with gas through four National Air-Oil burners, there being two burners on each end of the furnace. The furnace is also provided with a hot air recirculation system to effect a lowering of fuel consumption. Union Steam pumps, size 12 by 5½ by 12 inches, are used for crude charging work, there being one auxiliary unit.

FRACTIONATING COLUMN

In the lower section of the fractionating column the residium is dropped from the rising vapor, conducted through the exchanger system and to the cooling coils. At this point it is picked up by the Union Steam duplex pump, size six by four by six inches, and discharged to storage. The gravity of this product is held around 19.5° A. P. I.

The upper portion of the fractionating column is divided into three sections and provided with means for the withdrawal of three side streams. The lower stream is withdrawn as gas oil and is conducted into the top of a small vertical stripper section mounted on one end of the condenser box supports. As the gas oil descends into the stripper section it is met with a jet of hot steam which effects the removal of any light vapors not desired in the finished gas oil and these vapors along with the steam are conducted through a small line back into the side of the fractionating column.

In the section above this the

kerosene fraction accumulates and is withdrawn from the column and handled in the same manner as described above in connection with the steam flashing of the gas oil cut. The stripper sections are each equipped with Fisher liquid level controllers which do not permit the accumulation of distillate in the stripper pots but cause it to be removed in regular flow through the water submerged cooling coils.

Above the kerosene condensing section in the fractionating column there is provided a section for the accumulation and removal of heavy naphtha, which may likewise be withdrawn through a flashing or steam stripper pot and flashed with steam to desired specifications. This section, however, is not in use under the present method of operation. At this time all of the gasoline fraction is withdrawn from the top of the column in one cut and conducted through the vapor to oil exchanger and then over into the condenser coils and receiving house.

Temperature of the tower top is controlled both by means of the exchanger surmounting the column, and by means of trim stock which is pumped back into the tower from finished gasoline run down storage over the uppermost bubble tray. Westco-Chippewa rotary pumps driven by 5-horsepower General Electric motors are used for recycling trim stock over the tower. The temperature of the vapors at the tower top are controlled to produce end point gasoline of 62.5° A.P.I. gravity. The temperature at this point in the tower, as well as the temperature of the oil in the preheater inlet and the transfer line, is recorded by automatic recorder Leeds-Northrup thermometers. A potentiometer located beside the recording instruments in the control house also indicates temperatures at 10 other points in the distillation system.

Gasoline and naphtha, when produced, are taken from the tower to one condenser box. Under the present arrangement where naphtha is not made there is an auxiliary condenser box for use in the event of repairs being needed. The hotter streams, needing only cooling rather than condensing, are taken through coils in a second condenser box.

From the condensing and cooling boxes the three streams are conducted to look-boxes which are located on a raised platform portion of the single control room and pump house. In this manner the stillman has his control instruments, pumps, and his finished streams all in the same room. This design adds to the ease of operation and control. The operator is further assisted in control by reason of the close proximity of his furnace fires just outside of the control house. Under the present method of operation the streams coming back into the control room through the look boxes are 62 gravity gasoline, 42 gravity kerosene, and 32.5 gravity gas oil.

In connection with the operation of the larger pumps charging crude an interesting item is found in the adoption of metal receptacles filled with oil which are wired to the piston or drive shaft of the duplex pumps just at the point where the rocker arm meets the drive shaft. This point on the average duplex pump is often the most neglected, or if it is regularly lubricated the oil is allowed to spill on the floor. One of the operators at the plant is said to have perfected this idea and the small rectangular metal cans are firmly wired to the drive shafts, partially filled with oil, and as the pump operates the oil is continually splashed on the bearing connecting the rocker arm to the piston.

In addition to this unit, the Houston Oil Company has recently installed a small Foster pipe still for use in connection with its re-running operations when the Dubbs cracking units are producing pressure distillate for re-distillation. Formerly this still consisted only of a bubble tower in which pressure distillate was steam distilled. The new pipe still adds materially to its capacity and to the ease of control of its operation.

Hold Plant Operators Meeting at Breckenridge April 22

Natural gasoline plant operators of the North Central Texas will hold their annual meeting at Breckenridge, April 22. This group of members of the Natural Gasoline Association of America will present seven papers of interest to operating personnel of natural gasoline plants, holding their meetings in the City Hall auditorium. Manufacturers and others interested are invited to attend. F. G. Yonker of Chestnut and Smith Corporation, and Dean Hiatt of the Texas Pacific Coal & Oil Company are arranging the program.

Dr. E. R. Lederer, vice-president of the Texas Pacific Coal & Oil Company, and president of the association, will preside at the two sessions. Opportunity for discussion will be provided after the reading of each paper.

The following program has been announced:

Morning session—10 a. m.

"Boiler Operation and Maintenance" by L. D. Scarborough, Boiler Inspection & Insurance Company, Dallas.

"Meters and Operation," D. A. Sillers, Lone Star Gas Company, Dallas.

"Safety Talk," H. N. Blakslee, National Safety Council; and Don J. Wallace, director safety section, Mid-Continent Oil & Gas Association.

"Care and Operation of Gasoline Plant Machinery," D. B. Hiatt, Texas Pacific Coal & Oil Company.

Luncheon.

Afternoon session—2 p. m.

"Regulators and Controlling Devices," E. H. Triphaus, Taylor Instrument Company, Dallas.

"Loading and Handling of Finished Gasoline," Otto Peters, Brooks-Hanlon Gasoline Company, Breckenridge, Texas.

"General Maintenance of Field Gathering Lines and Drips," Phillips Petroleum Company.

Open discussion of operating problems.

Selection and Application of Insulating Materials At Gasoline Plants[1]

By T. S. TULIEN
Johns-Manville Sales Corporation

IN making a selection of the insulation to be used in a gasoline plant three things should be taken into consideration; namely, suitability, efficiency and application.

Under the heading "suitable," temperature, durability, and location must be considered. The life of the insulation will be very short if the temperature limit of the material selected is below the temperature of the equipment to be insulated. Likewise a high temperature insulation would not be economical on a low temperature surface. Insulation that will protect against heat losses from a steam line will not be suitable for protection against evaporation from a gasoline storage tank or as a fire proofing material.

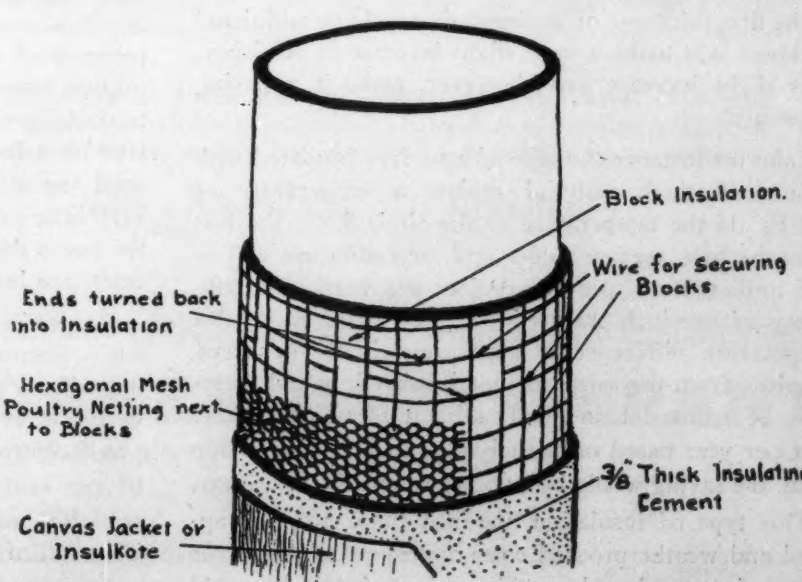
The weight of the insulation may be a factor in one instance and in another the location of the equipment may be such that the insulation will meet with excessive wear from an outside source. Again it may be necessary, for some reason, to frequently remove the insulation in which case a material of high salvage value should be used.

Eighty-five per cent magnesia is probably the best known of all insulating materials. It is very economical insulation against heat losses in gasoline plants, where the temperatures encountered come well within the maximum limit of 550 to 600°F. at which temperature magnesia will begin to calcine. If properly manufactured it has sufficient strength and workability to allow application without waste. Eighty-five per cent magnesia, as the name implies is made from a mixture of 85 per cent carbonate of magnesia and 15 per cent asbestos fiber, and it is very important that the proper kind of fiber and proper mixture is used. In order to give maximum service the fiber mixture should be such that, when breaking the insulation, it is necessary to tear it apart. The result of a poor mixture or improper fiber, is a material that breaks apart with a snap when pressure is applied or an attempt made to form it around a cylindrical surface. The breakage in the case of such a material is high.

Increase in Efficiency of Insulation as Pipe Size Increases

Pipe size Inches	Thickness of Insulation Inches	Efficiency Per Cent
1	1½	73.21
2	1½	78.88
3	1½	81.34
4	1½	82.58
6	1½	83.89
8	1½	84.79
10	1½	85.12
12	1½	85.44
16	1½	85.75
Flat Surface	1½	86.25

Another insulating material suitable for the tempera-


Block Insulation.
Wire for Securing Blocks
Ends turned back into Insulation
Hexagonal Mesh Poultry Netting next to Blocks
3/8" Thick Insulating Cement
Canvas Jacket or Insulkote

Method of applying insulation to flat or cylindrical surfaces.

[1]Presented before California Natural Gasoline Association.

tures encountered, is one made up of laminations of asbestos felt composed of asbestos fiber and small particles of spongy cellular material. This type of insulation is especially designed to withstand wear and tear and will remain permanently in place without disintegration or lowered insulation value. Such insulation should be used in locations where the material will have to withstand abuse or where high salvage value is desired.

For insulation against evaporation losses a low temperature insulation should be used. There are several types suitable such as vegetable cork, rock cork or hair felt. Of these the last named has proved as economical and satisfactory as any.

Although there is not the same need for fire protection insulation in a gasoline plant that there is in a refinery, still there are times when such insulation would prove a cheap insurance. The suitability in this case depends not only on conductivity but also on the ability to withstand high temperatures without breaking down structurally. There are a number of good insulating materials on the market, but very few that have the combined qualities of low conductivity and ability to withstand high temperature. A coarse ground material made from mineral Celite has been found very suitable in that it possesses these qualities to a marked degree.

ECONOMICAL EFFICIENCY

After the "suitability" of a material has been determined its economical efficiency should be considered.

Here again 85 per cent magnesia meets the requirements as insulation against heat losses or for the control of temperature. While this type of material will return a certain per cent on the initial investment, or will give certain definite results as to temperature control it does not follow that doubling the thickness will make the results twice as good. The rate of transfer of heat from the metal surface of the equipment being high, and the rate of transfer through the insulation being low, it follows that the bulk of the saving is made by the first thickness of the insulation and any additional thickness will make a very slight increase in efficiency. This slight increase may, however, make it a paying investment.

Take for instance the case of a surface insulated with a one-inch thick material against a temperature of 200°F. If the temperature of the air is 50°F. the loss from the bare surface under still air conditions will be 3.15 million B.t.u. per square foot per year. The efficiency of one-inch thick 85 per cent magnesia at this temperature difference is approximately 84 per cent. The loss from the same surface insulated, would therefore, be reduced to one-half million B.t.u. per square foot per year based on a fuel value of $.25 per million B.t.u. the saving would be $.66 per square foot per year.

This type of insulation one-inch thick properly applied and weatherproofed costs approximately $.50 per square foot, so based on this saving of $.66 it would pay for itself in approximately eight months. Suppose now that the insulation be increased to a thickness of two inches. This would increase the efficiency to 91 per cent and the cost of the insulation applied to $.65 per square foot. Based on an efficiency of 91 per cent the heat loss would be reduced to .28 million B.t.u. per square foot per year and the savings would be practically $.72 or $.06 more than for the one-inch insulation. In this case 2½ years would be required to pay for the extra cost of increasing the thickness. Expressed in per cent return on the investment the one-inch insulation would show a 132 per cent return whereas the additional thickness would show a 40 per cent return.

On the other hand, the life of the equipment, or length of time the plant is to be used, determines to a large extent the economy of the additional thickness. Taking into consideration all of the existing conditions the most economical thickness can easily be computed. However, some manufacturers of insulation have worked out tables showing the proper thickness for various temperatures, all of the controlling factors having been taken into consideration, so by referring to these, a great deal of work can be eliminated.

These tables show the economical thickness of pipe covering for temperatures encountered in gasoline plants in Southern California to be approximately one inch thick, or, as this thickness is designated, standard thick; insulation for cylindrical surfaces under 250° F. to be 1½ inches thick and over 250° F. and under 500° F. to be two inches thick. The thicknesses shown for cylindrical surfaces include finishing cement and weather-proofing. Just as there is an economical maximum thickness, there is an economical minimum thickness. This minimum thickness is determined by the structural strength of the material rather than by any insulating value.

Magnesia, while it is an efficient insulation against heat losses, would not be economical or suitable as a cold insulation, as for instance in the case of gasoline tank insulation. In a great many cases gasoline is stored in pressure tanks, but regardless of this, the temperature of the liquid may become such that the evaporation losses will be high when released from the tank to containers at atmospheric pressure. This is especially true on a hot summer day. If a large storage tank is used the structural strength of the tank is such that very little pressure, if any, can be applied. In this case the losses due to breathing, and in some instances, wind drift, are large.

Proper insulation has proved a very economical remedy. Records kept over a period of years show that by using a three-quarter-inch thick hair felt over the deck and eaves, with leaks sealed with a special fume proof cement the losses have been reduced as much as 85 per cent. Based on the saving, the insulation has paid 100 per cent on the investment in a few months. This return on the initial cost of insulation depends, of course, upon the size of tank and conditions before insulating. It might sometimes be economical to cover

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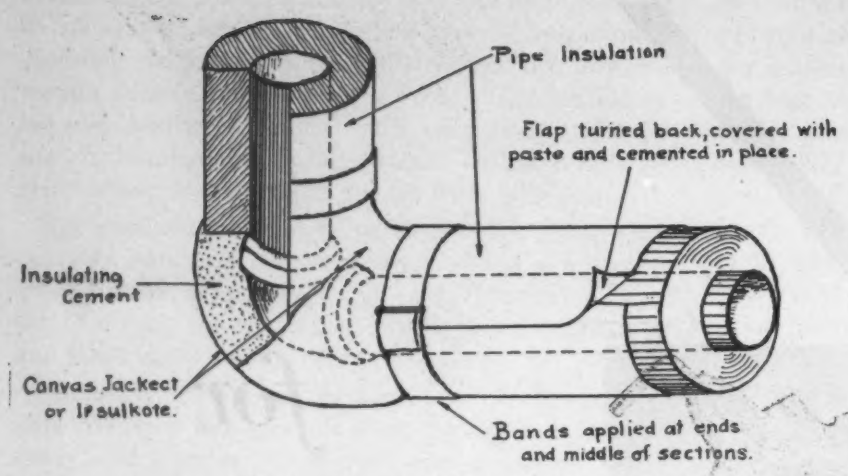
EXPORT SALES REPRESENTATIVE—Oil Field Equipment Co., Inc., 30 Church Street, New York City.


Pipe Insulation
Flap turned back, covered with paste and cemented in place.
Insulating Cement
Canvas Jacket or Insulkote.
Bands applied at ends and middle of sections.

Sketch showing method of applying pipe covering and insulating adjacent fitting.

the entire tank, but it is advisable to first refer the matter to the insulation manufacturer.

The most economical thickness of insulation for fire protection depends largely on the hazards and the probable duration of the fire. Nine hundred degrees is usually taken as the critical temperature for steel supports. If the structure reaches a temperature greater than this there is danger of failure. Test runs show that a mixture of four parts of Sil-O-Cel C3, which is a coarsely ground calcined diatomaceous earth, and one part of Portland cement by volume, made up in plastic form and applied on the equipment to be fireproofed to a thickness of two inches will keep the temperature below 900° F. for a period of from four to five hours. In the majority of cases a fire which has not been extinguished in this time, is beyond control, and further protection would be useless.

We now come to the last point to be considered, namely, application. Although the most suitable and efficient material may have been selected, the insulation can be a complete failure, as far as results are concerned, if it is not properly applied. Care should be taken that the insulation material fits up tight against the surface to be insulated. As few joints as possible should be used and these joints well sealed so as to prevent the heat from leaking out at that point.

Insulating cement is used for covering irregular surfaces such as fittings, and as a finish on cylindrical surfaces that have been insulated with block insulation. This cement should be allowed to thoroughly dry before applying the finishing or weather-proofing coat. If the weather-proofing is applied before the cement is dry there is danger of this finish cement coat separating from the block insulation and spauling off.

As a rule it is better to apply insulation when the equipment is hot, as this will not only dry the cement quicker, but will also tend to eliminate any danger of the insulation cracking due to expansion of the metal. It is of prime importance that the weather-proofing be applied so that there are no openings or leaks which will allow water to get into the insulation.

A wet material has a high conductivity and if the insulation is allowed to become wet because of cracks in the weather-proofing it is of little value. Since the application of insulation is of prime importance I believe it would be well to explain this more or less in detail.

I will outline first the method of insulating pipe lines and fittings. Pipe insulation is furnished in split sections, three feet long, made up in one layer of various thicknesses, or several layers, depending upon the type of insulation desired. Temperatures encountered in gasoline plants are such that more than one layer is seldom used, and I will therefore, limit the description of the application to a single thickness.

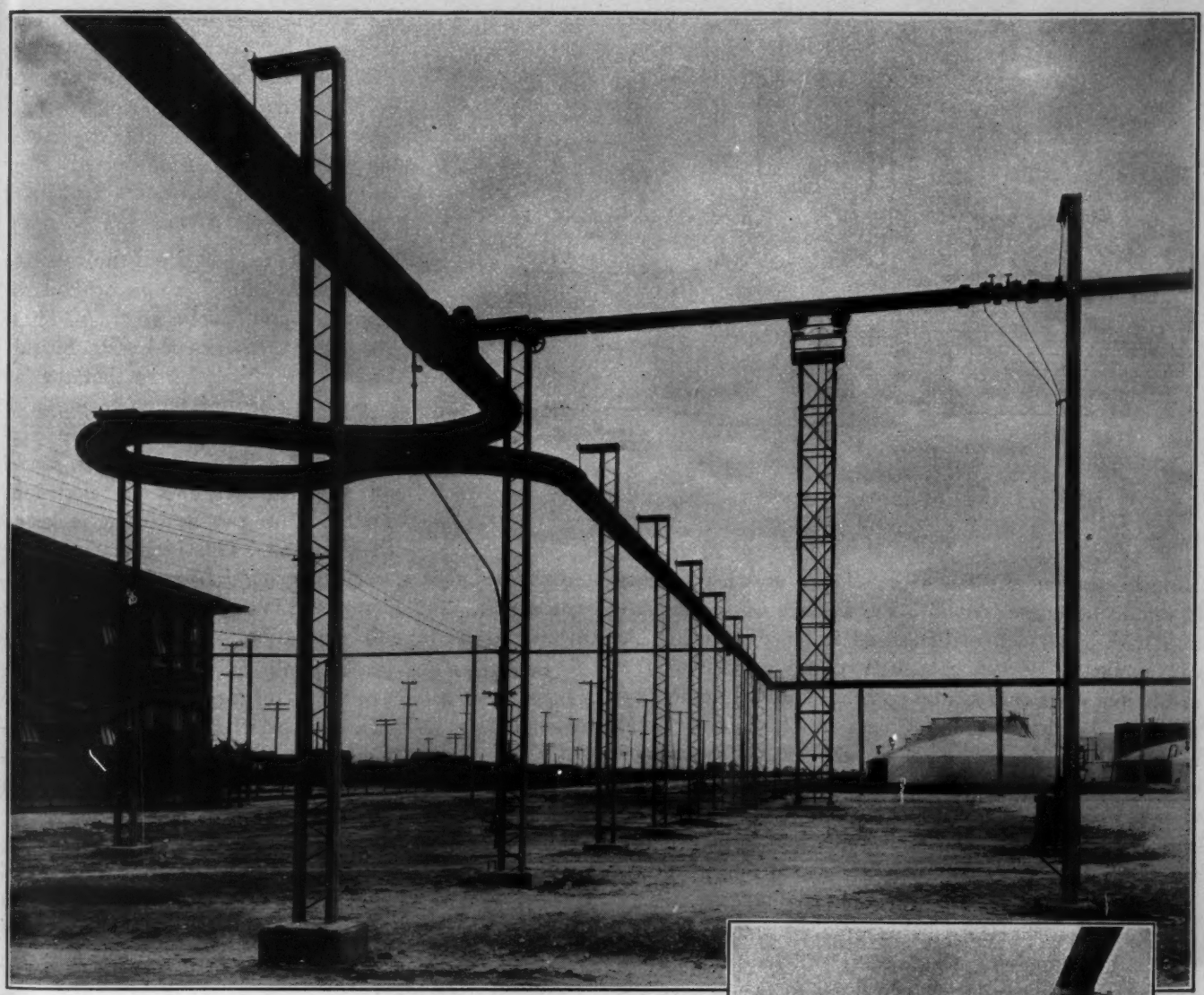
Insulation for sizes of pipe less than 10 inches is furnished by the manufacturer with a light canvas jacket pasted to the surface of the covering with a flap extending over the longitudinal joint so as to make a complete seal. There is also an end lap for sealing the joints between sections. This canvas jacket is peeled back even with the longitudinal joint of the covering, which is then placed around the pipe to be insulated.

By means of a large paint brush, cold water paste is applied to the underside of the flap and to the outer portion of the canvas jacket which this flap will cover. The flap is then drawn back tightly over the seam and rubbed down so as to make it secure. The end flap on this section is then pulled back even with the covering and the next section applied in the same way, being sure to force it up tight against the preceding section so as not to have an open joint. The end flap is then pasted down over the joint in the same manner as the lateral flap.

Two lacquered bands are furnished with each section of covering. After the covering is in place one of these bands is fastened securely around the covering at the end joint, and the other midway between the ends of the section.

Eighty-five per cent magnesite covering, for sizes larger than 10-inch pipe, is furnished in block form, 36 inches long, without the canvas jacket. To apply covering of this size a small flexible rope should be placed around the pipe with a light coil spring inserted between the two ends. Each segment is then placed on the pipe under the rope, the tension of the coil spring tending to hold these segments in place until the entire circumference has been covered. The covering is then fastened securely to the pipe by means of black annealed wire, of 14 or 16 gauge, with the ends twisted up tight with a pair of pliers and turned down into the insulation so as to leave no sharp points protruding.

These wires should be placed on approximately 8 to



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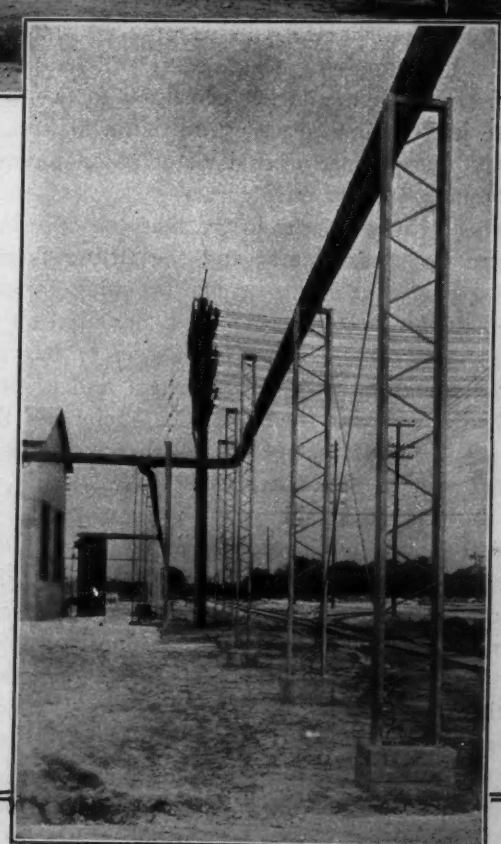
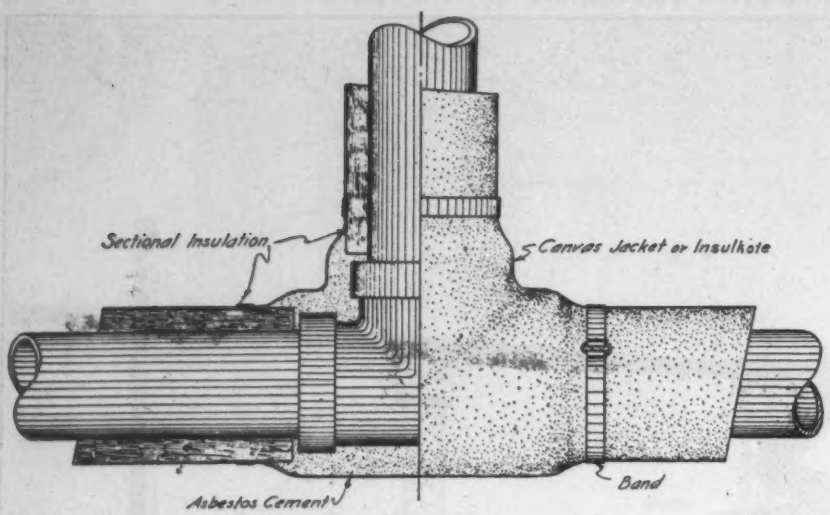


Two illustrations showing Truscon hot dipped galvanized Weltrus Steel Poles used for the purpose of pipe supports.



Method of applying insulation to screwed fitting.

10-inch centers. As the wire is being drawn up tight, it should be hammered into the surface of the insulation with a wooden mallet so as to leave it flush. A canvas jacket is then cemented to the surface of the insulation with cold water paste. A good method of applying the paste to the jacket is to mix a fairly thick mixture in a bucket, and dip the entire section of canvas in this, so as to thoroughly saturate it. The excess paste can be removed from the canvas by taking one corner of it in one hand and drawing it through the fingers of the other hand. Lateral and end laps should not be less than three inches.

Approximately two pounds of cold water paste is required for applying a hundred lineal feet of covering furnished with the jacket cemented to it. Where the entire jacket must be pasted on the insulation, approximately five pounds of cold water paste is required for 100 square feet of surface area.

Where fittings occur in the line, the covering should be run up to this point and the fitting then covered with a plastic insulating cement to within approximately one-fourth-inch of the surface of the adjacent pipe covering. After this first coat of cement has dried the crack should be filled with cement and a second coat applied bringing it flush with the surface of the covering. When this second coat is dry a canvas jacket is pasted over it in the same way as previously described for the pipe covering.

If the covering is to be painted, it should be first primed with a cold water paint, mixed to a thickness at which it will just run freely. Approximately five pounds of the dry powder are required for a mixture to paint 100 square feet of surface. The insulation should be then painted with at least two coats of a good grade of lead and oil paint. It is very important that the line be primed before painting with the lead and oil paint, otherwise the oil in the paint will penetrate into the insulation and decrease, or even entirely destroy, its efficiency.

If the insulated lines are on the outside, exposed to the weather, the insulation should be protected by a water-proof covering. Probably the most satisfactory and economic material to use for this purpose is an asbestos roofing felt. Asbestos felt is composed of asbestos fiber and asphalt and will not dry out and rot like rag felt or canvas.

The felts are cut from the roll into strips wide enough to go around the insulation and make a good lap. These strips are then fastened over the surface of the insulation so that the lap is on the side oof the covering with the edge down to properly drain. Sixteen gauge galvanized iron wire placed on approximately six to eight-inch centers is used to secure the jacket to the covering. This jacket, if properly applied, makes a neat appering job, and is more efficient than paint in that the latter may crack and allow water to get into the insulation.

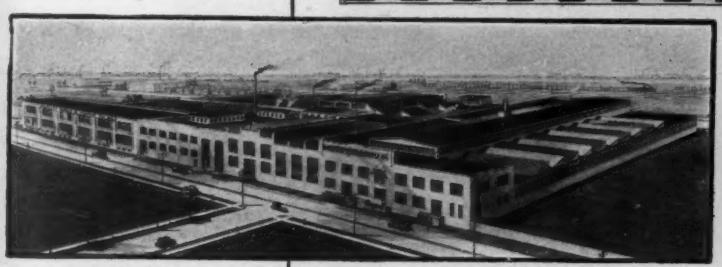
Insulation for large cylindrical surfaces or flat surfaces is furnished in block form six inches wide by 36 inches long, of thickness specified. To apply this insulation a light flexible rope is placed around the circumference of the surface to be covered, with a light coil spring inserted between the ends the same as described in the case of large pipe covering. This spring should be of sufficient length to allow for the increased diameter resulting from the applied insulation. This rope, with the coil spring, affords a simple means of holding the block insulation in place until it can be permanently fastened.

Starting at the bottom edge of the surface to be insulated, the blocks should be applied with the 36-inch length running parallel with the axis of the cylinder. Each alternate block should be broken in two, making an 18-inch length, so as to stagger the joint. After this first course has been placed around the entire circumference, the blocks are fastened in place by means of black annealed wire of 14 or 16-gauge.

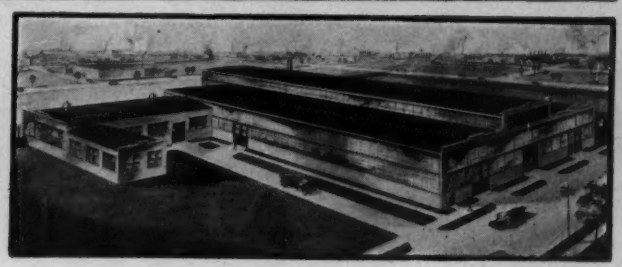
The wire should be drawn tight by one man, with a second man hammering it in flush with the surface of the insulation by means of a wooden mallet. The ends should then be twisted up tight, cut, and turned into the surface of the insulation so as not to leave any sharp protruding points.

When the entire surface has been so covered, a one-inch hexagonal mesh poultry netting should be placed over the entire area of the insulation, with all joints laced together with 16-gauge black annealed wire. In case there is any bulging in the poultry netting it should be held close to the insulation by means of hair pin staples. These can be made from the same 16-gauge annealed wire, and should be of a length which will not penetrate the entire thickness of the insulating block.

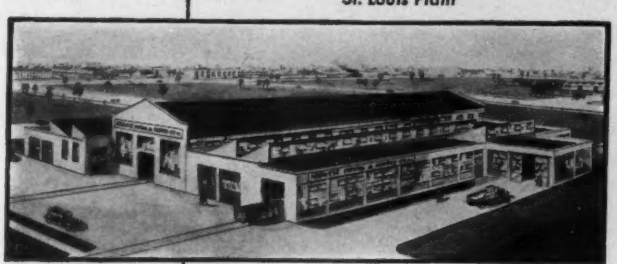
Next plastic insulating cement is applied over the



St. Louis Plant



Passaic, N. J., Plant



Los Angeles Plant

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entire surface to a thickness of approximately three-eighths-inch and finished to a smooth true surface. Approximately 1½ pounds of the dry cement is required per square foot of the surface to be covered. After the cement has been allowed to thoroughly dry, all cracks should be buttered up with this same insulating cement.

The insulation is now ready for applying a weather-proofing material. In case a pasted on canvas jacket is used it should be applied and painted in the same way as previously described. If a sewed on canvas jacket is desired, a 72-inch wide eight-ounce canvas usually is used. The canvas should be placed around the surface to be covered with its length running around the circumference, the two ends doubled under, and after it has been drawn tight, sewed with a No. 6 Irish flax thread. The lateral seams should be sewed in the same manner. As a rule it is easier to stretch the canvas tight, if application is started at the top of the cylinder or tower being covered, and working down from this point. The jacket should then be painted the same as in the case of the pasted on jacket.

There is always danger of leaks due to cracks in a painted surface and we have found that plastic materials, made up of asbestos fiber and asphaltic compounds, such as Insulkote for instance, make an exceedingly good weather-proofing jacket, and one which is also more or less resistant to fire. This material is applied in plastic form to thickness of approximately one-eighth-inch by means of a trowel. It can be worked to a very smooth finish. Approximately one pound is required per square foot area to be covered.

For fire-proofing columns or steel frames of any kind, the simplest method is to build forms for the desired thickness, the same as for concrete. A mixture is then formed by using 32 pounds of Sil-O-Cel C3 with one bag of Portland cement. This is then poured into the forms, well tamped, and allowed to set. After it is dry the surface can be primed and painted if so desired.

Chemical Treatment of Petroleum Distillate

(*Continued from page* 68)

what may be expected more and more in the future with the growth of large business concerns having a research staff working on their own problems.

Government specifications often become standard for the general buying public, and in the case of gasoline and kerosene are good standards by which to judge the finished product. Special orders may usually be met by slight variation from methods which meet government requirements. The American Society for Testing Materials (A.S.T.M.) also co-operates with government bureaus in promoting the adoption of reasonable specifications and standardizing methods for testing these products. The bulletins of the Bureau of Mines and A.S.T.M., might safely be termed the Bible of the treating plant man so far as treating specifications are concerned.

In the light of these standards the most important characteristics with which the treating plant is concerned are: sulphur content, corrosion, reaction with doctor, color including color stability, and gum content, which will probably also be extended to include gum-forming properties. Numerous attempts have been made to develop a satisfactory test which would distinguish between straight run and cracked products and indicate in the case of the cracked product the efficacy of chemical treatment. These took the form of tests for unsaturated hydrocarbons such as iodine number, bromide number, absorption by sulphuric acid, etc., but failed of general adoption because of lack of uniformity or results by various methods, and also lack of ability to interpret the results as beneficial or detrimental when the test was made. Interest in these non-paraffin groups of hydrocarbons has been revived with the appearance of anti-knock evaluation and various chemical methods of determining the different groups devised, but at present the tendency is to test for results rather than groups, and the detrimental effects are largely summed up in gum formation and color, while the beneficial effects are summed up in anti-knock value which is determined by actual tests in an internal combustion engine under some specified conditions, and compared with some anti-knock substance of known amount and value.

RAW MATERIAL

The raw material, or treating stock, will in this case be a light distillate, but its previous history is of vital interest to the treator. Is it a straight run or cracked distillate? Has it been fractionated to some specific distillation range which is to be maintained for the finished product, or is it to be re-run? If straight run from crude oil, what is the type of crude, nature of sulphur compounds, and if possible to know, what sort of treatment has it had for breaking B.S. emulsions, etc? This latter point is becoming more important than many realize. Formerly B.S. was dumped or burned. Conservation and pollution problems have stopped this practice. Next came physical methods for breaking these emulsions, such as heat and centrifuging.

Now we have come to chemical methods with a plethora of solutions, crystals and oils of animal, vegetable, and coal tar origins, and the Lord only knows what next will be given some fancy trade name and sold to the producer for breaking B.S. emulsions. The ap-

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plication of these treating compounds may in many cases be left to a tank gauger who figures that if a little will do some good, more will do more good. The compounds are in practically all cases soluble in oil, else they could not be used because oil is the external phase of these emulsions and in order to reach the emulsifying agent they must be soluble in the external phase. When we contemplate how small an amount of some unstable compound may, for example, throw a water white oil off color we may realize what these unknown bodies may do in the way of causing grief for the treating plant force.

An item of perhaps smaller import, but not to be overlooked is the problem of changes made in the operation of stills, or cuts to be included in the treating plant stock. Treating plant operators are certainly entitled to any such information having a bearing on their work. An old battery of stills which has not been in operation for some time will change the sulphur requirement in the doctor reaction because of free sulphur picked up in condenser coils, arising from the conversion of iron sulphide to the oxide. In a carefully balanced system these things are not to be disregarded.

Fractionation is becoming more and more important in relation to chemical treatment; and the question arises if the future may not see this carried to the point where it will give all the purification necessary for finished product, with perhaps the addition of some catalyst in the fractionating tower. This is already claimed for one well-known process of refining, by using Fuller's earth in the vapor phase.

The last two questions, namely; the type of treatment to use, and methods for checking progress form the subject matter of the remaining articles.

Paper presented at Columbia Gasoline Corporation Foremen's meeting

Injectors and Inspirators

By T. F. WILLIAMS

EVERY operator that uses an injector or inspirator should understand the fundamental principles of their operation or, as it were, what caused the injector or inspirator to raise and force water.

Injectors may be divided into two general classes —non-lifting and lifting injectors—non-lifting injectors are intended for use where there is a head of water available, but where a lifting injector is used, as is generally the case when the injector is the only means of getting water into the boiler, the operator ought to know what is taking place within the injector, that causes it to lift water from the bayou or pond or whatever source the water may be coming from.

Lifting injectors are of two distinct types, called automatic and positive injectors. As positive injectors generally have two sets of tubes, they are frequently called double tube injectors. Automatic injectors are so called from the fact that they will automatically start again in case the jet of water is broken by jarring or other means. Positive or double tube injectors are provided with two sets of tubes; one set of which is used for lifting the water, and the other set for forcing the water thus delivered into the boiler.

A positive injector has a wider range than an automatic injector and will handle a hotter feed water supply; it will also lift water to a greater height than the automatic injector. The principle of the working of the injector is that the entering steam in passing through the nozzle acquires high velocity and is condensed by the water in the combining tubes creating a vacuum, into which the water flows, through the water supply pipe, because the pressure in the vacuum is lower than the atmospheric pressure that is being exerted against the surface of the water in the bayou or pond, thus forcing the water

The high velocity steam entering through the nozzle drives the mixture of condensed steam and water into the injector through the supply pipe.

With the modernization of natural gasoline plant equipment and processes the designing engineers have been enabled to locate plants of large capacity upon very small plant sites. With efficiencies far in advance of practice five years ago, and with modern compact equipment, the 20,000 gallon plant or plant of much higher capacity requires less of area and no more of labor than did the small plant of a few years ago.

The bubble type absorber, for example, doing the work of perhaps eight baffle type towers, requires but about one-fifth the space. Vertical distillation equipment lends compactness to plant layout. Vertical steel storage tanks still further reduce the area once required. Exchangers in line and often tiered required but little space. All modern equipment tends toward accessibility.

The non-lifting injector works on the same principle as the lifting injector except that it is used only where there is head of water available with a pressure greater than the atmospheric pressure, but after the water is forced into the combining tube it is delivered to the boiler by the non-lifting injector the same way as it is by the lifting injector.

An important condition which must be fulfilled in order that the injector will work is that the supply of water must be sufficient to condense the steam. As the temperature of the supply water rises, the

for

• BAD SCALE CONDITIONS •

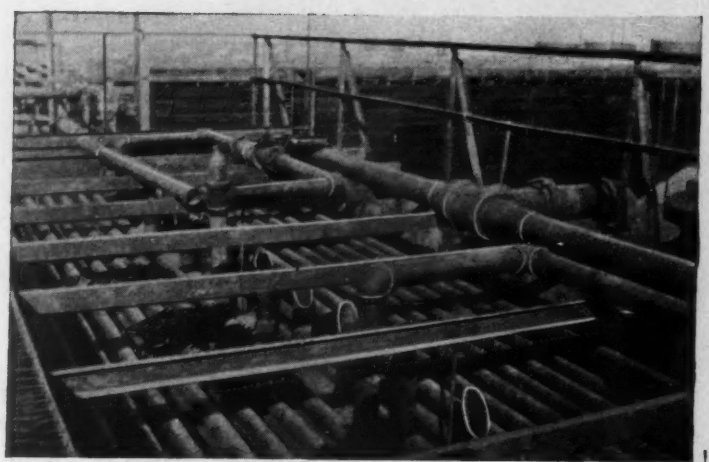
use

CONDENSER COILS

of

ARCO METAL

CAST IRON PIPE



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An Installation of

3" ARCO METAL PIPE

— in exact 32 foot lengths — with Arco Metal Return Bends.

This installation has 38,400 feet of pipe in four coils.

FOR those localities where extremely bad water is encountered — where other types of condensers foul too rapidly — use coils of ARCO METAL PIPE. It can be obtained in single pieces as long as your coil, its natural flexibility will tend to crack scale so most of it will fall off, while the rest can readily be cleaned off. Such coils will be efficient, easily cleaned and durable since ARCO METAL PIPE is cast from a corrosion-resisting nickel-chromium iron.

Let us discuss your problem with you — no obligation — write us.

Arco Metal Pipe is distributed to the oil industry by the National Supply Companies and Crane Co., and is carried in stock in the stores of the National Supply Co., in the cities shown below.

Augusta, Kans.
Beaumont, Tex.
Blackwell, Okla.
Borger, Texas
Charleston, W. Va.
Cushing, Okla.
Duncan, Okla.
Eldorado, Kans.

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Newark, Texas
Okmulgee, Okla.
Shreveport, La.
Torrance, Calif.
Tulsa, Okla.
Toledo, Ohio

Plant at Springfield, Illinois

amount of water required for condensing purposes will be greater.

SIZE OF INJECTOR

Most engineers prefer to select a size of injector having a capacity per hour about one-half greater than the maximum evaporation per hour, in order to have some reserve capacity. The maximum evaporation when not known may be estimated in gallons by one of the following rules, which hold good for ordinary combustion rates under natural draft.

For plain cylindrical boilers, multiply the product of the length and diameter in feet by 1.3.

For tubular boilers, either horizontal or vertical, multiply the product of the square of the diameter in feet and the length in feet by 1.9.

For water tube boilers, multiply the heating surface in square feet by .4. For boiler not covered by the foregoing rules multiply the great surface in square feet by 12.

LOCATION OF INJECTOR

An injector must always be placed in the position recommended by the maker. It is absolutely necessary to have check valve in the feed-delivery pipe. The check valve should never be omitted, even if the injector itself is supplied with one. No valve should ever be placed in the overflow pipe, nor should the overflow be connected directly to the overflow pipe, but a funnel should be placed on the latter so that the water can be seen.

This direction does not apply to the inspirator or to any other injector that has a hand-operated separate overflow valve.

In the inspirator, the overflow pipe is connected directly to the overflow, but the end of the pipe must be open to the air.

STEAM SUPPLY TO INJECTOR

The steam for the injector must be taken from the highest part of the boiler as it must be supplied with dry steam. Under no consideration should the steam be taken from another steam pipe. The suction pipe should be as straight as possible and must be air tight. In connecting up an injector the pipes should be cleaned by flowing them out with steam before making the connection, because if a small bit or dirt gets into the injector it will interfere seriously with its operation.

INJECTOR TROUBLES

In the discussion of injector troubles as given in succeeding paragraphs, the suction pipe, strainer, feed-delivery pipe and check-valve are considered as parts of the injector. In searching for the cause of the trouble, therefore, the suction and delivery pipes should be carefully inspected as well as the injector.

The causes that prevent an injector from raising water are:

(1) Suction pipe stopped up. This is due generally, to a clogged strainer or to the pipe itself being clogged at some point. In case the suction pipe is clogged, steam should be blown back through the pipe to force out the obstruction.

(2) Leaks in suction pipe. This prevents the injector forming the vacuum required to raise the water. To test the suction pipe for air leaks, plug up the end and fill the pipe with water, then turn the full steam pressure on the pipe. The presence of small leaks will be revealed better by water than by steam.

(3) Water in the suction pipe too hot. A leaky steam valve or leaky boiler check valve may be the cause of hot water or steam entering the source of supply and heating the water so hot that the injector refuses to handle it.

(4) Obstruction in tube: There maybe an obstruction in the lifting or combining tubes, or the spills (or opening) in the tubes through which the steam and water escapes to the overflow maybe clogged with dirt or lime.

In some cases an injector will lift water, but will not force it into the boiler; or it may force part of it into the boiler and the rest out of the overflow. When it fails to force, the trouble may be due to one or the other of the following causes:

(1) Partly choked suction pipe or strainer. If the suction pipe or strainer is partly choked, the injector, in either case will be prevented from lifting sufficient water to condense all the steam issuing from the steam valve. The uncondensed steam, will gradually decrease the vacuum in the combining tube until it is reduced so much that the injector will not work.

(2) Suction pipe leaking. A small leak in the suction pipe will have the same effect on the injector as a partly clogged suction pipe.

(3) Boiler check-valve stuck shut. If the check valve is completely closed, the injector may or may not continue to raise water and force it out of the overflow; this depends on the design of the injector.

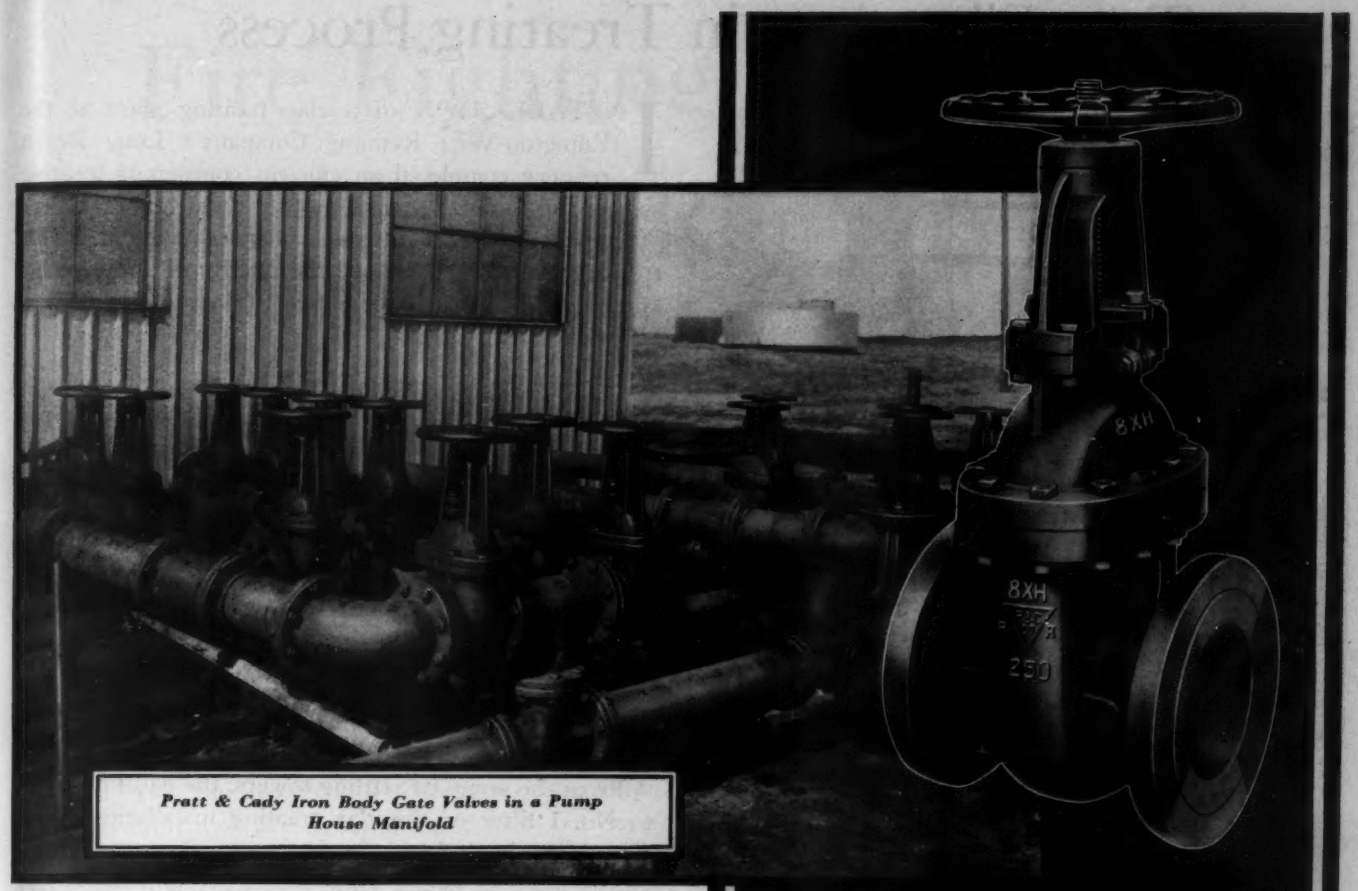
(4) Obstruction in delivery tube. Any obstruction in the delivery tube will cause a heavy waste of water from the overflow.

(5) Leaky overflow valve. A leaky overflow valve is indicated by the boiler check chattering on its seat.

(6) Injector choked with lime. It is essential to the proper working of an injector, that the interior of the tubes be perfectly smooth, and the proper bore. As in course of time they become clogged with lime, the capacity of the injector decreases until finally it refuses to work at all. To remedy this trouble remove the tubes and put them in a bath consisting of one part of muriatic acid to 10 parts of water. The tubes should be removed from it as soon as the gas bubbles cease to be given off.

The advantages of the injector as a boiler feeding apparatus are its cheapness, as compared with a pump of equal capacity. It occupies but little space, the repair bills are low, owing to the absence of moving parts, no exhaust piping is required, as with a steam pump and it delivers hot water to the boiler.

The disadvantages of the injector is that it will not start with a steam pressure less than that for which it is designed, and that it will stand but little abuse, as it is not usually adapted for handling water containing grit or other matter liable to cut the nozzles.



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Seats renewed quickly and easily-

Seat ring wear is a costly matter when you have to remove gate valves from the line . . . costly from the standpoint of replacement and labor as well.

Pratt & Cady Retaining Ring construction is a distinctive time-tried design for renewing seats—so practical that the renewal is easily made without taking the valve out of the line.

These economical features of the Pratt & Cady Iron Body Gate Valve are largely responsible for its widespread acceptance by the Petroleum Industry. Let us give you complete information. Address

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"There can be no compromise with safety"

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AN ASSOCIATE COMPANY OF AMERICAN CHAIN COMPANY, Inc.
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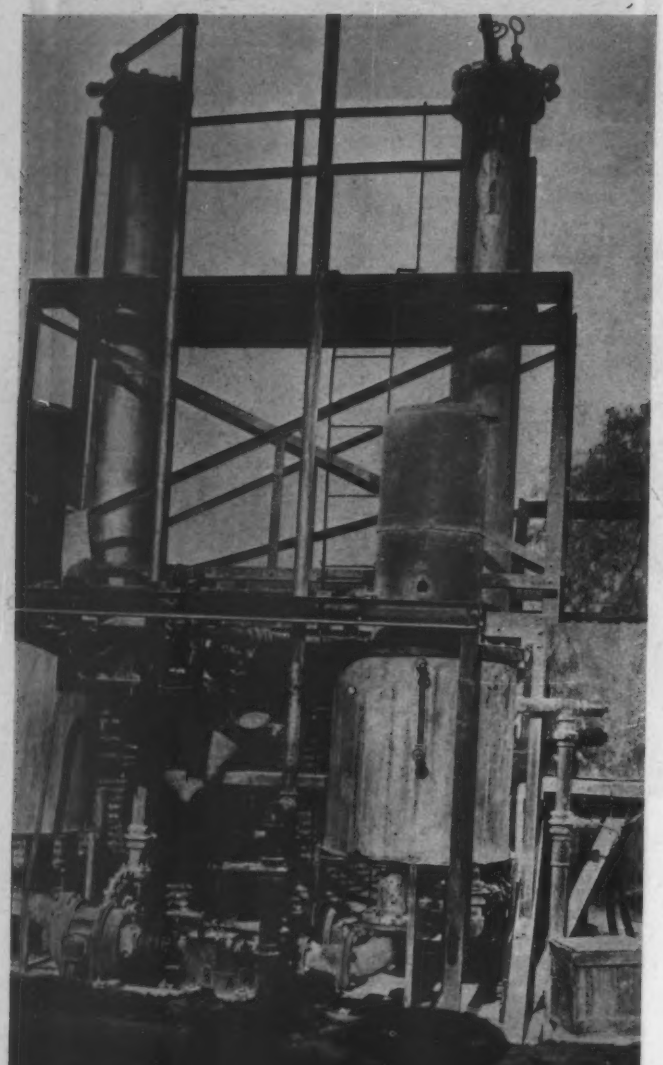
Two Filtrations in Treating Process



Filters in clay treating plant.

INSTALLATION of a clay treating plant at the Edington-Witz Refining Company's Long Beach refinery completed an efficient continuous treating system and removes several problems which are a source of constant worry with less modern equipment. This treating plant has improved the quality of the gasoline and has made possible the refining of more oil with less effort and cost.

The gasoline is pumped from the rundown tanks to storage before treating with acid. As it is pumped from the rundown tanks it is treated with a weak solution of caustic soda, 3 Be. As the gasoline is pumped to the storage tanks, the caustic is drawn off.

From the storage tanks the gasoline goes to the first tower of the acid mixing unit, where any water is settled off. It goes through a Miller mixer and is given about five-tenths of a pound of acid to the barrel of gasoline. Three settling towers of the same dimensions as the one used for settling off the water are used for removing the acid from the gasoline.

From the series of settling towers, the gasoline passes to No. 1 filter of the clay treating installation. This filter is pre-coated with hy-flo super cell.

The gasoline passes from the No. 1 unit to the No. 2 filter, and thence to storage. In the first filter a mixture of 25 per cent hy-flo super cell and 75 per cent refiner's clay is used. In the No. 2 filter, straight refiner's clay is used.

In the No. 1 filter, about three-tenths of a pound of the 25-75 mixture is used per barrel, while in the No. 2 filter about two-tenths of a pound of refiner's clay is used per barrel of gasoline. The net result with this combination is a product of 30 plus color, and generally better.

Returning to the condition of the gasoline before it reaches the acid treating columns, it was observed that it would pass both the corrosion and doctor tests. This was brought about by a careful application of the caustic treatment.

Long Beach crude is being refined extensively. The nature of this oil makes it necessary to use the acid chiefly for color, while the clay treating process neutralizes the acids and places the necessary polish of the finished product.

About 100 barrels of gasoline per hour is being treated, with the treating plant running about 10 hours per day.

Water settling and acid settling tanks in continuous treating systems.

Fire Fighting Equipment In the Refinery*

By E. E. KERNS
Louisiana Oil Refining Corporation

IT is firmly believed that 98 per cent of the fires in our oil refineries are preventable. The refineries of 10 years ago were quite different from the refineries of today. Oil fires in those days were thought of as being something that could not be prevented and their daily occurance was merely considered as a part of the business. This meant loss of running time, often times loss of equipment and frequently snuffed out lives that could never be replaced.

Today, with the advanced knowledge of operation and with improved fire fighting equipment we have been able to reduce such hazards to a low level. Many workmen of this day do not consider working in an oil refinery any more hazardous than working in a printing press or a machine shop. Not only is it essential to have adequate fire equipment but it is just as important to keep this equipment in good condition and ready for use at all times. The equipment should be given constant attention to make certain that it will serve its purpose when the need arises. To be sure of this it is necessary to conduct periodic and frequent inspections of the foamite, water and steam systems.

In considering these three systems separately and briefly, there are certain factors that must be considered in the original design as well as in the upkeep. In laying out a foamite system it is of prime importance to have sufficient chemical storage to take care of the oil storage capacity of said plant and to have pumps of sufficient size to pump these chemicals to the desired location. To determine the capacity of a pump, five gallons per minute should be figured for each 100 square feet of oil surface of the tank having the largest diameter. Then install two pumps of this capacity so as to have a square in case two or more tanks go afire at the same time, or in case it is necessary to repair one pump.

The proper size lines should be used in order to get the desired quantities of solutions to the source of fire. Insofar as possible all mains should be looped so that solutions as well as water reach any point from two directions. All property protected should be divided into sections and the mains should be so valved that solutions can be delivered to each section individually. Drip cocks should be placed at frequent intervals and at all low points to provide complete draining of lines after use. Of course, we must take into consideration the line friction from the pump to the hose nozzle, the static head between the pump house and the bottom of the tank at the highest elevation and the height of the mixing chamber or top of the center column above the bottom of the tank. Adding these pressure losses to 50 or 75 pounds per square inch, which should exist at the nozzle, gives us the delivery pressure on the pump and this pressure should not exceed 150 or 200 pounds per square inch maximum. Hence, a safety valve on the pump is of great importance to prevent excess pressure.

PERFECT MECHANICALLY

For a fire pump to deliver solutions under these pressures it must be in first class mechanical condition. Slippage tests ought to be conducted at frequent intervals, preferably every four months if the pump is seldom used. If this test shows a slip greater than six or seven per cent the pump should be overhauled immediately. Now assuming that the pump is in first class condition, are the mains and laterals capable of withstanding the pressure? Due to the alkilinity of many soils, underground lines are subjected to corrosion and must therefore be inspected and tested from time to time. It is wise to make hydrostatic tests of all foamite as well as water lines with the maximum operating pressure at least once a month.

It is also important that the hydrant valves be kept in easy working condition and the threaded hose connections on the hydrants be clean, bright and free from rust. Some form of protection over the threads such as grease or a covering cap is a good investment. The hose threads should conform to those in use by the nearest large city fire department so as to enable the use of their equipment, if necessary. Hydrants should be so located that each tank, still, agitator, separator, loading rack, oil pump house and buildings where oil is handled or stored can be reached from at least one hydrant without using an excessive length of hose. Then after the hose is at-

*Paper read before Western Petroleum Refiners Association, Shreveport meeting, March, 1930.

tached to the hydrant, will it withstand the subjected pressure? Frequent testing of all refinery hose with water pressure will determine this point.

Now that the chemicals have successfully reached the fire, are they of the proper strength to produce the best expansion and thus give the desired results.

There are just two ways to extinguish fire. One is to cool the material below its burning point which is usually accomplished by the use of water. The other method is to smother the fire by cutting off its supply of oxygen. Water, steam, and ordinary chemicals have little or no effect on inflammable liquid fires. Too often, water adds it sown share to the damage of property by spreading the burning liquid over a wide area. This latter is accounted for by the fact that most inflammable liquids are lighter than water. Instead of being extinguished by an application of water or weak chemical solutions consisting chiefly of water, they float and continue to burn. For this simple reason, not generally understood, such "extra-hazardous" fires cannot be cooled out, by wetting, but must be smothered out by cutting off their supply of oxygen. In order to completely cut off this supply it is essential that a blanket be formed by the uniting of the acid and basic solutions. Weak solutions, strong solutions or any variation whatsoever will not produce the best results. Hence, solution storage tanks should be agitated once each week and samples taken for the purpose of testing the expansion properties. If the volumetric expansion of the mixture falls below seven the solutions should be checked separately for correct gravities. Solutions in storage will loose their strength with duration of time, making it necessary to continually add chemicals to the storage tanks.

NEED FOR APPARATUS AROSE

The success of the foamite method of smothering out fires under a blanket of firefoam created a genuine need for apparatus that could produce more foam than foamite extinguishers and engines and eliminate the necessity of mixing and separate storing of two solutions.

The portable Foamite foam generator is designed to back up the smaller but necessary "first aid" foamite equipment, and can be put into instant service with a larger sized stream of firefoam, the supply of which is only limited by the availability of water and the Foamite generator power. The operation of this generator is simplicity itself. Its lightness and compactness permit its being carried by one man and all that is necessary is to set it up at a distance not greater than 150 feet from the fire. The rate of flow of water through the generator automatically controls the drawing of the right amount of powder into the stream.

But before going farther, let me ask one question. This equipment cannot operate by itself, therefore, do we have a well rounded and well organized force who knows exactly where these portable mixers are located, how they are to be connected to the hydrant, and if there is sufficient power on hand or readily accessible to combat a fire of any size? We must bear in mind that in every plant, however small, there should be a well trained squad consisting of the regular employees that can capably handle this equipment for maximum efficiency. But all burden must not fall upon this particular group of men, but they should be the ones who should start the ball to rolling. Then by the assistance of other employees we might picture this large force efficiently using this valuable equipment for the purpose for which it was designed.

Similar rules apply to the high pressure water system. Sufficient pumping capacity should be calculated, based on the oil storage capacity of the plant. The supply of water should last for at least 24 hours, continuous pumping. If your plant is located in a section of the country where electrical storms are frequent and where electrical power is used for driving fire pumps it would not be wise to have all of them electrically operated. Assuming that half of the fire pumps are driven by electric motors, assuring quick starting, then the remaining pumps should be driven by either steam, gas engines, oil engines, or gasoline engines.

LOCATION IMPORTANT

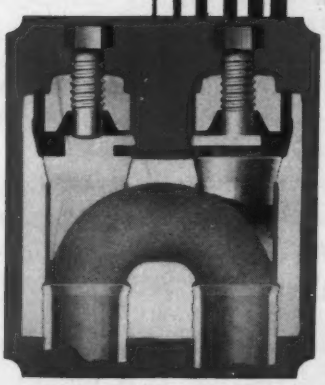
All fire pumps should be located in detached, noncombustible structures or in a separate room of fire-resistive construction, with standard cut-off from all other portions of the building. The location of fire pumps under condenser boxes in oil refineries is not considered good practice.

All tanks, except those containing paraffin, lubricants or oils of a non-gaseous nature, should be equipped with water spray on the roof and water curtains. All warehouses, woodworking establishments, docks and such other places as it may seem advisable, should be protected with sprinkler systems. These may be either automatically or manually operated, as local conditions may dictate, and should conform as closely as possible to the requirements of the National Board of Fire Underwriters.

All hose should be 2½-inch in size, and should be four-ply, rubber covered, rubber lined, of an approved brand suitable for 200 pounds pressure. It should be wound single on the hose reels and hose reels ought to have a capacity of 250 feet of hose. An ample supply of hose is essential. The use of stationary play nozzles for special locations such as docks, on the tops of high structures, and the like, is strongly recommended. Too much equipment can do no harm while an insufficient or a defective system may result disastrously.

As for steam protection—steam of sufficient quan-

OHIOLOCK FRICTIONLESS
---increases "Throughput" 15% to 20%



Increased production naturally comes with the installation of Ohiolock Frictionless Return Bends.

The uniform "Frictionless" oil passage through the fitting reduces turbulence and pressure drop to a minimum.

The resulting 20% increase in throughput means more profit to you from each Frictionless-Equipped unit.

Increase "throughput" from 15% to 20% by taking advantage of the reduction in turbulence and pressure drop which comes with the installation of Ohiolock Frictionless Return Bends.

These fittings provide a passage through the bend of about the same diameter as the inside of the tube, there being no abrupt changes of direction or sharp corners to retard the smooth flow of oil through the return bend.

Besides this important feature, the Ohiolock Frictionless includes all those well known time and labor saving advantages of the simple quick-acting Ohiolock closure. Thus you have double economy—first in increased production from greater throughput and second, the increase which comes from turning part of what was formerly wasted time in dismantling fittings for tube cleaning into productive time.

That is why so many of the major refineries are specifying these return bends of modern efficiency.

Let their experience be your guide. Learn how Frictionless can be adapted to your units.

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The Mark of Safety for the Vital Spot of Your Pressure Units

tities is often times of great help. Steam hose and hose connections should be found on all equipment. It serves as an easy, inexpensive and quite efficient means of caring for small fires and in preventing flashes where minor leaks develop. It is also good practice to provide all pump rooms, receiving houses, and all outside buildings and shops with steam smothering lines. Steam smothering mains and laterals should not be buried or lie directly on top the ground but should rest on blocks or have some form of overhead support. It is needless to say, that all steam lines carrying a steam pressure should be well insulated.

Then, let us consider the importance of gas gathering lines and gas tight roofs on tanks storing light oils and especially those containing any great amount of hydrogen sulphide. The control and recovery of gasoline vapors in tank farms is closely related to the production of natural gasoline and at the same time keeps these vapors from saturating the surrounding atmosphere. Gas tight roofs are undoubtedly a good investment in reducing evaporation losses and in cutting down the hazard connected with escaping vapors. But, I must emphasize the real necessity of current inspections to be certain that the roofs or the part of the tank in the vapor area does not corrode through. We all know that iron oxide forms on all metal exposed to the weather.

CHEMICAL ACTION MAY OCCUR

In storing light volatile oils from West Texas crudes where hydrogen sulphide gas is found in large quantities, a chemical action takes place that should be noted. Ferric sulphide (Fe_2S_3) is obtained by gently heating a mixture of iron and sulphur or by the action of sulphuretted hydrogen on the sesquioxide below 100 degrees. It also combines with other sulphides of iron. The hydrated sulphide is rapidly decomposed by air and in absence of air undergoes spontaneous decomposition into ferrous sulphide and iron disulphide. The anhydrous sulphide is pyrophoric if suddenly brought into contact with air. Hence, we can see what happens when a tank roof rusts through and air is allowed to enter. Then, how often should tank roofs be inspected? That depends entirely upon the condition of the roof. If a roof has been in service for some period of time and its condition is in doubt—give it special attention.

In concluding, the writer wishes to emphasize the importance of adequate fire fighting equipment. After the installation of this equipment it is just as essential to keep it in first class condition. This can only be accomplished by frequent and regular inspections and repairs made accordingly. Some inspection department should be maintained in each and every refinery regardless of size. The cost of operating such a division is very low when compared with the value of equipment protected.

National Petroleum Association Program Announced

THE program for the semi-annual convention of the National Petroleum Association to be held at the Cleveland Hotel, Cleveland, Ohio, April 23 and 24, has been arranged with the purpose of presenting for discussion subjects of the most timely interest to the refining industry.

E. M. Lyons, president of the association, in his opening address will deal not only with the association activities but with subjects especially pertinent to the oil industry. Alfred Reeves, general manager of the National Automobile Chamber of Commerce, will discuss "Advantages That Come from Co-operation in the Motor Industry."

E. B. Reeser, president of the American Petroleum Institute, will present a discussion of the industry's problems and progress. A. M. Maxwell, vice president of Standard Oil Company of Ohio, will address the convention on the subject of marketing.

C. F. Kettering, president of General Motors Research Corporation, will confine his discussion to subjects of common interest to the manufacturer of motors and the manufacture of motor fuels and lubricants, and will answer questions in subsequent discussion of his remarks. Warren Platt, National Petroleum News, will discuss the economic problems of the industry.

H. S. Bell, refinery engineer, will present an illustrated paper dealing with "Developments in Foreign Refining." D. G. Brandt, of Henry L. Doherty & Company, will discuss "Modern Trends in the Manufacture of Motor Lubricants." Willis Crane, traffic attorney for the National Petroleum Association, will present a paper dealing with traffic problems.

There will be short talks from the association's board of trustees dealing with the activities of the new organization. O. P. Keeney, chairman of the program committee, is also trustee of the Department of Standards and Tests and will make his report. N. H. Weber, in charge of the Department of Trade and Commerce; P. S. Tarbox, who supervises the Department of Manufacture, and G. C. Davison, whose special interest is research in manufacture, will report for their various sections. R. A. Wotowitch, trustee in charge of the Department of Fire Prevention and Safety; Houston Dunn, who manages the National Petroleum Mutual Fire Insurance Company, and James H. Herbert, president of the Fire and Safety Marshals of the National Petroleum Association, will talk on their respective activities. H. G. Dunmire, of Valvoline Oil Company, will present a paper on "Crystallization of Wax in Paraffin Distillate."

The first aid teams of Standard Oil Company of Ohio, Conewango Refining Company, Independent Refining Company, and probably Kendall Refining Company and Pennzoil Company, will compete for prizes in a first aid contest.

The annual fellowship supper will be held this year at the Hermit Club, Wednesday evening, April 23.

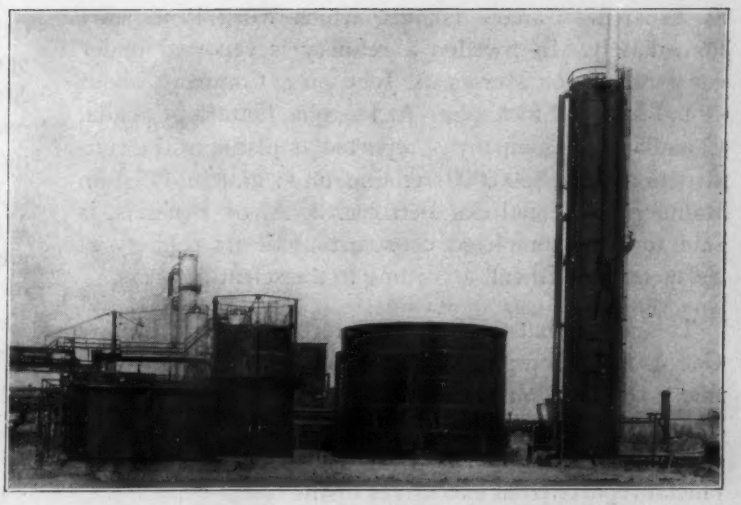
ARMCO INGOT IRON

reduces upkeep in refinery equipment

YOU need not pay excessive toll to metal maintenance. Tanks, tubing, pipe, agitators . . . there are many places where corrosion-resisting Armco INGOT IRON brings low-cost service, greater profits from operations.

There is no guesswork when you use this durable pure iron. Tested by twenty-three years of rigorous service, pre-proved by experience, Armco INGOT IRON has the longest record of *actual service* of any low-cost, rust-resisting sheets and plates.

Shall we send an Armco Engineer to tell you more about Armco INGOT IRON: its exceptional service record and the *plus-values* which cost you nothing extra—consistent uniformity, workability, and weldability?



The Hamilton Coke & Iron Company, Hamilton, Ohio, uses Armco INGOT IRON for all metal equipment. Among these installations is the battery of tanks shown above, consisting of Fresh Wash Oil Tank, Motor Fuel Tank, Light Oil Tank, Agitator Building, Meter Tanks, Purified Solvent Tank, and Washed Products Tank.

The office nearest you offers this helpful service. Write, wire or phone.

Back of this familiar symbol is nearly thirty years' experience in the manufacture of special analysis iron and steel sheets and plates. When you want a rust-resisting, low-cost metal be sure to see this triangle and the words, "Armco Ingot Iron." It is your assurance of dependable, economical service.

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"Be Sure It's Made of Armco INGOT IRON"

Continued Development in Manufacturing Indicated

CONTINUED expansion of manufacturing facilities in the refining industry is indicated by current reports of company activities. Five refineries in foreign countries are reported this month and two plants are proposed in this country.

Chief of importance in foreign fields is the joint venture of Associated Oil Company and the Nitsubishi interests of Japan in the construction of a complete refinery of 4000 barrels capacity with 1500 barrels cracking capacity to be located near Tokyo, Japan. Espanola de Petroles has been reported to have signed contract for the construction of a $1,000,000 refinery at Teneriffe, Canary Islands, which work is to start immediately. In Sweden a refinery is reported under construction for Messrs. A. Johnson & Company, about 40 miles from Stockholm. At Petrolia, Ontario, Canada, Canadian Oil Company is reported as planning the construction of a $500,000 refining unit; and in Belgium Raffinerie National des Petroles, S. A. of Brussels, is said to have completed construction of its refinery at Selzaete, near Ghent, according to the scientific press.

The rumor that the Doherty interests through Empire Gas & Fuel Company would erect a 20,000-barrel refinery on the Houston, Texas, ship channel and a pipe line from Oklahoma fields to this point has been given credence by the reported purchase of a site and semi-official reports from executives of the company. Another East Coast refinery is indicated by the report that Shell Eastern Petroleum Products Company, a subsidiary of Shell Union Oil Company, plans the construction of a plant at its property at Sewaren, N. J. which is now used in part as a bulk distributing plant.

A new refinery in the Panhandle area of Texas entered the lists when Petroleum Refractionating Corporation began operations at its recently completed 4000-barrel capacity plant at Pampa, Texas. At this same city Wilcox Oil & Gas Company has purchased the skimming plant of Pampa Refining Company with a capacity of 3000 barrels daily. It is reported that cracking equipment will be added later.

Amarillo Producers and Refiners Corporation has resumed operation at Pyote, Texas, upon negotiation of a new crude oil contract with American Oil Company. The capacity is rated at 3000 barrels daily. In Montana Arro Oil & Refining Company, Lewiston, which has been on a part time operating basis has begun operating on a continuous schedule at a rated capacity of 2000 barrels daily.

Old Dutch Refining Company, Muskegon, Michigan, has completed repairs and the installation of additional distilling equipment and is operating at the rate of 2000 barrels daily. Another small refinery has been operating in the Dallas, Texas, district and is known as Texas Eagleford Oil & Refining Company. The plant was built from salvaged material from an old installation at Greenville, Texas, and is rated at 1000 barrels capacity.

Reports from Billings, Montana, stated that Laurel Oil & Refining Company should have its new refinery in operation during the month of April. In the Rocky Mountain district Utah Oil Refining Company is dismantling some obsolete equipment and replacing with modern equipment to effect an increase in capacity.

White Star Refining Company at its Trenton, Michigan, refinery is adding a third Dubbs cracking unit and is installing additional reaction chambers to the two older Dubbs units. At Okmulgee, Oklahoma, Barnsdall Refineries, Inc. is installing a new Model A Cross cracking unit to replace an old unit of the same type. New power plant equipment is also being added.

Texas Pacific Coal & Oil Company at Fort Worth is completing the installation of additional direct expansion ammonia refrigerating equipment. Oil Creek Refining Company, Titusville, Pennsylvania, also a manufacturer of lubricants, is doubling the capacity of its filtration plant. Also McKean County Refining Company, Farmer's Valley, Pennsylvania, which was recently purchased by The Pennzoil Company, is giving its plant a general reconditioning and expanding through the addition of a barrel house, wax house, boiler house and boilers, a burner building and 12 new filters.

Crystal Oil Refining Corporation, Shreveport, has shut down its plant with the announcement that certain alterations and extensions are to be made. Magnolia Petroleum Company has denied reports that it contemplated the erection of a refinery at Sweetwater, Texas.

Six natural gasoline plants are reported under construction, four of which are in Texas and two in Oklahoma. This compares with six new plants reported during the month of February.

(*Continued on page* 146)

Bureau of Mines Publishes Bibliography Of Petroleum

MANY a petroleum engineer, geologist, and field superintendent has had occasion to feel grateful to the charming young lady whose photograph is reproduced on this page. She is Miss Melissa Speer, bibliographer for the Petroleum Field Office of the United States Bureau of Mines at San Francisco, who compiles the monthly abstract of published material relating to petroleum and allied substances which is published by the bureau in cooperation with the American Petroleum Institute and the Special Libraries Association, the latter an organization whose members include librarians and technicians connected with industrial libraries and laboratories. She and her volunteer assistants, who include two dozen men and women occupying responsible positions in the technical branches of the petroleum and allied industries, undertake to read and study every worthwhile periodical published in the English, French, German and Russian languages. Miss Speer herself peruses 30 periodicals published in English and French in search of material which might be of interest and benefit to the American oil man; and her assistants examine and report on material found in the industrial and technical publications of the United States, Canada, Great Britain, France, Germany, Roumania, Russia and other countries.

Miss Speer is assisted in the study of French publications by M. P. Doss of The Texas Company, at New York and R. E. Schaad of Universal Oil Products Company, at Chicago. German publications are divided between Miss Isabella Brokaw of the Chemical Research Laboratory of Standard Oil Company, Indiana, at Whiting, and C. D. Lowry, Jr., and Valentine Mekler, both of Universal Oil Products Company, Chicago. D. F. Brown of the Standard Oil Development Company, Elizabeth, New Jersey, who also is chairman of the Special Libraries committee, reports on all patents covering machinery and appliances designed for use in drilling, production, pipe line, and refinery operations. Other members of the joint committee include the following:

Marion E. Hull, Atlantic Refining Company, Philadelphia; Thelma R. Reinberg, Batele Memorial Institute, Columbus, Ohio; H. Matossian, Combustion Utilities Corporation, Linden, New Jersey; Albert Althoff, General Petroleum Corporation, Los Angeles; Arthur E. Ruark, Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh; Charles M. Rath, Midwest Refining Company, Denver; Helen L. Adams, The Ohio Oil Company, Finley, Ohio; O. M. Buch, Pan American Petroleum and Transport Company, New York; B. C. Frichot, Shaffer Oil & Refining Company, Cushing; Charlotte Schaler, Sinclair Refining Company, New York; J. F. Cassidy, Standard Oil Company of California, Richmond, California; Ruth Etzold, Standard Oil Company of New Jersey, New York; C. R. Dooley, Standard Oil Company of New York, New York; Raphael Tourover, Washington, D. C.; Florence W. Lundell, Tulsa Public Library, Tulsa; Basil Turner, Petroleum Research Corporation, New York; E. H. Burroughs, Union Oil Company of California, Wilmington, California; C. R. Miller, White Star Refining Company, Detroit, Michigan; Gertrude E. Page, Department of Water and Power, City of Los Angeles, Los Angeles; Anna F. Fry, Western Precipitation Company, Los Angeles, and Barbara McClintock, Bureau of Mines, Bartlesville, Oklahoma.

The bibliography, which is entitled—Recent Articles on Petroleum and Allied Substances, is divided into 10 sections, as follows:

General.
History and Geographic Occurrence.
Geology and Origin.
Development and Production.
Transportation, Storage and Distribution.
Properties and Their Determination.
Refining and Refineries.
Utilization.
Legislation and Legal Regulations.
Miscellaneous.

The abstracts or digests which it contains are boiled down to the very briefest review of the contents of each paper, as for example:

Struth, H. J. East coast logical field for future refinery expansion. Ref. and Nat. Gas. Mfr., Vol. 8, Oct., 1929, pp. 75-77. Demand exceeds output, Venezuela a factor, developments pointing definitely to consistent future increased crude production. Influx of petroleum on Atlantic coast from California and foreign sources. See also Oil Weekly, Vol. 55, Oct. 18, 1929, pp. 21-22, 62.

TRADE NOTES and COMMENT

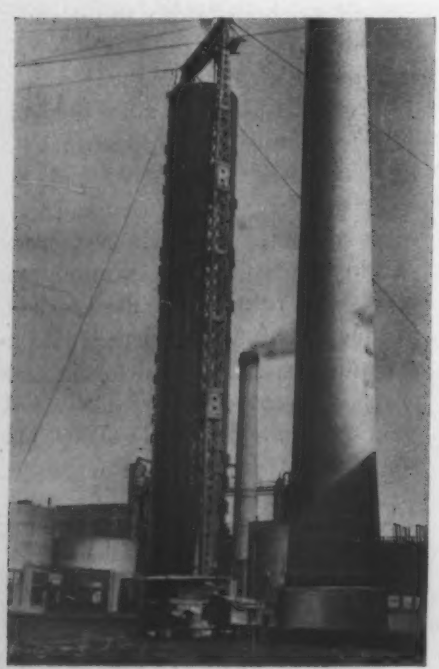
By GEORGE REID

Sun's New Topping Unit

SUN Oil Company, at its Marcus Hook, Pennsylvania, refinery, recently completed construction of a new skimming unit, atmospheric pressure distillation, of 15,000 barrels daily capacity. Fractionation equipment working in conjunction with this pipe still installation consists of one modern bubble type column or tower.

The tower is one of the largest of its kind in the refining industry and presented several problems in its transportation from Chester, Pennsylvania, to Marcus Hook, and its subsequent erection at that point. This column is 97 feet 11 inches in height. Its diameter is 13 feet 4½ inches, and its overall weight is 242,228 pounds. It was assembled, shipped and erected as a complete unit.

Being of larger diameter than the standard clearance for bridges and passing trains and cars on sidings, special arrangements had to be made with the Reading Railroad whereby all adjacent tracks between Chester and Marcus Hook were cleared. In crossing the railroad bridge across Chester Creek where that stream empties into the Delaware River actual measurement between the sides of the column and the structural work of the bridge was just an inch to spare on each side. Loaded on two oversize flat cars the column in its travel from shops to refinery caused the removal of several small buildings and telephone poles from the side of the railroad right-of-way because of the overhang of 10 feet and 10 inches, at the curves of the track.



According to Alen Knight, engineer in charge of the construction of the plant, the job of getting the new equipment in place at the plant was no small task, but proper plans and preparations had been made. On each side of the tower foundation, three feet square, concrete piers were placed to carry the hoisting equipment. Two gin poles were placed on these piers. In the accompanying illustration one of the gin poles is visible. They were held together at the top with a cathead composed of 24-inch "I"-beams. From this cathead, two four-sheave steel blocks were hung and rove with one-inch plow steel cable, which was extended from the blocks at the bottom of the poles to two cranes. The tower was placed so that its center was over the foundation and the cable slings put in place. Each crane was put into service. When the tower was six inches off the flat cars the cars were removed so that one car could be used for the base of the column to rest upon, while the head-end was placed on its cribbing. Then the cable-slings were moved to within 25 feet of the head-end, the cranes started lifting again and as the tower was raised the base rode in toward the foundation on the one flat car. Soon the tower was upright and the flat car hauled from underneath. The rails were then removed and the tower lowered back on the foundation. Two hours were required from the time the cranes hooked to it, until the tower was on its foundation.

In reporting the experience in "Our Sun," Knight gives much credit to Harry Montgomery and Jack Kulp, the rigger and labor bosses, for the manner in which they handled this very large piece of equipment without mishap.

Helium Great Industrial Gas

BY virtue of science and research, helium, first sought as the ideal gas for airships, is taking its place among the greater industrial gases. Ideal applications have been found for it in the fields of food preservation, caisson work, metallurgy, grading and separating powdered materials, especially those of a combustible nature, and as a circulating medium in drying operations, according to the Helium Company, of Louisville, Kentucky.

Helium has characteristics peculiar to it alone which indicate its wide use. It will neither burn nor explode and is non-poisonous. It is colorless and odorless and only slightly heavier than hydrogen—the lightest of gases. Its lower rate of diffusion through gas bags, and its non-inflammable characteristic make it ideal for airships. It is almost completely inert and enters into no chemical association with other substances excepting mercury and platinum, and with these only under special conditions. It is valuable in metallurgical operations because of its insolubility in metals.

After research had shown that the solubility of helium in water and aqueous solutions is only half that of nitrogen, and its rate of effusion more than three times greater, experiments were carried out with it for use in deep sea diving and caisson work. Mixed with oxygen it is used as a breathing atmosphere for divers working at greater depths with greater comfort and with much shorter periods for decompression.

Put into an atmosphere of helium a cake will keep indefinitely. Half a cake, preserved six months, was found to be as tasteful and as fresh as when it was put in storage. With orange juice the results have been about the same. Such interesting facts regarding an important by-product of the petroleum industry serve to indicate a possible wider usage of this unique gas. Helium is prepared by a process of compression and liquefaction.

Litharge Costs in Chemical Refinement

FIFTEEN per cent of the Litharge (Lead Monoxide), produced in the United States is consumed by the refining industry in the chemical treatment of its petroleum distillates. At current market prices the use of this commodity represents an annual expense of $2,176,000 for "Doctor" treating and other uses which, however, are of very minor consequence in the demand figure.

Through the assistance of Robert L. Ziegfeld, of the Lead Industries Association, who made a survey of his membership for the writer in an effort to determine the importance of this chemical both to the lead industry and to the refining industry, we are able to present this interesting bit of information that out of a total production of litharge in 1928 of 85,570 tons, the refining industry consumed 12,800 tons of the product. According to reports from the National Lead Company, the Eagle Pitcher Lead Company, Metals Refining Company, Andrews Lead Company, the Sherwin-Williams Paint Company, Evans-Wallower Lead Company and W. P. Fuller & Company, which seven firms represent 90 to 95 per cent of the litharge production (excluding, naturally, other lead products) in the United States, 15 per cent of litharge

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PETROLEUM PLANTS

manufactured finds its way finally into the treating solutions of the refining industry. Figures of a similar nature for 1929 are now being compiled.

At the prevailing quoted price of 8½ cents per pound, the annual consumption of 12,800 tons of lead monoxide, costs this industry $2,176,000. Last month in these columns (issue of March, page 132) it was shown that sulphuric acid for treating purposes costs the indutry $17,270,000, and that caustic soda consumed by the industry costs $6,612,000. Adding the figure above covering the cost of litharge, and the estimated total cost of heavy chemicals for treating in the refining industry becomes $26,058,000.

The Purchaser

WHEN Colonel J. H. Graham became president of Indian Refining Company and moved the New York headquarters into the large general offices at Lawrenceville, Illinois, he secured Colonel F. B. Upham as buyer for the company. These two colonels had seen each other in action for some years during the recent fracas in Europe and had become fast friends. Colonel Graham had set aside an excellent office for the Director of Purchases, and he wanted a "regular fellow" for a buyer of materials and supplies rather than the usual, or what Elbert Hubbard so concisely describes as a typical buyer.

Despite the fact that Colonel Upham is all that the term "regular fellow" implies and has the happy faculty of remaining "regular" even after buying equipment for the newly developed Govers process which require much equipment that manufacturers never heard of before, Colonel Graham would have his little joke. Shortly after Director of Purchases F. B. Upham became settled in his office he was presented with a framed motto from his president which reads as follows:

"THE BUYER

By Elbert Hubbard."

"The typical buyer is a man past middle life, spare, wrinkled, intelligent, cold, passive, noncommital; with eyes like a codfish, polite in contact, but at the same time unresponsive, cool, calm and damnably composed as a concrete post or a plaster-of-paris cat; a human petrification with a heart of feldspar and without charm or the friendly germ, minus bowels, passions, or a sense of humor. Happily they never reproduce and all of them finally go to Hell."

Needless to state, the Hubbard description is unfair to Francis B. Upham, all of which, however, adds to the humor of the thing.

WITH a favorable court opinion, Standard Oil Company of New York and Vacuum Oil Company will come under one banner in world petroleum circles. The merger must await the decision of the courts, since the two concerns came into existence through the famous Standard dissolution decision of 1911.

When and if the court is willing, General Petroleum Corporation will be formed as a holding concern for the two companies. This will allow each to retain its present name and trade marks for operating and sales purposes. The merger is old so far as rumors go. The industry has been waiting for it several months. Its consummation will create a concern, second in size to the Standard Oil Company of New Jersey and one capable of upholding itself in any trade mart of the world.

Standard Oil Company of New York is the landlord at 26 Broadway, Standard Oil Company of New Jersey being a tenant. Standard Oil Company of New York has developed extensive export facilities, especially in the Orient. Its moves in Russia, to move oil from there to the market in India are of recent memory. In the home field, Standard Oil Company of New York sells petroleum products in New York and the New England states. Through Magnolia Petroleum Company it has extensive producing, pipe line, refining and sales in the Southwest. General Petroleum Corporation gives it similar hold on the Pacific Coast. Recent purchase of White Eagle Oil & Refining Company, gave it Middle Western territory.

Vacuum Oil Company is best known for its lubricating oil, Mobiloil, which is sold around the globe. Last year the company bought control of Lubrite Refining Company, St. Louis, and more recently has ventured into gasoline sales in the East.

What happens when Standard Oil Company of New York goes into court and asks the privilege of joining with Vacuum Oil Company will have weighty bearing on other events in petroleum and financial circles. If these two offshoots of old Standard can unite, what about others

A. F. GARRETT

A. F. Garrett has been elected vice-president of Chestnut & Smith Corporation of Tulsa. In this capacity Mr. Garrett will have charge of sales. He joined the Chestnut & Smith organization in February, 1930. For several years he has been identified with the petroleum industry in the Mid-Continent area and previous to his present connection was with Tidal Refining Company as general manager.

Continued Development in Manufacturing Indicated

(Continued from page 142)

In the Panhandle region of Texas F. C. Henderson Corporation is building a 14,000-gallon plant in Hutchinson County. Magnolia Petroleum Company is completing construction of a 10,000-gallon plant in Gray County, which was started by White Eagle Oil & Refining Company before its acquisition by Standard Oil Company of New York. Columbian Gasoline Corporation is erecting its fourth plant at La Fors, Texas, near Pampa. In Coleman County, West Central Texas, Texas American Syndicate, Dallas is erecting a one-unit gasoline plant to handle about 10,000,000 cubic feet of gas daily.

Crosbie, Moran, Inc., are building a 20,000-gallon plant in Section 8-6-6 in the Greater Seminole area, Oklahoma, and in the same territory Empire Oil and Refining Company is erecting a 14,000-gallon plant which is to be placed in operation this month.

The Texas Corporation is dismantling a small compression plant recently purchased from Continental Oil Company near Electra, Texas, and Phillips Petroleum Company is likewise dismantling two plants purchased in the Burbank field, Oklahoma.

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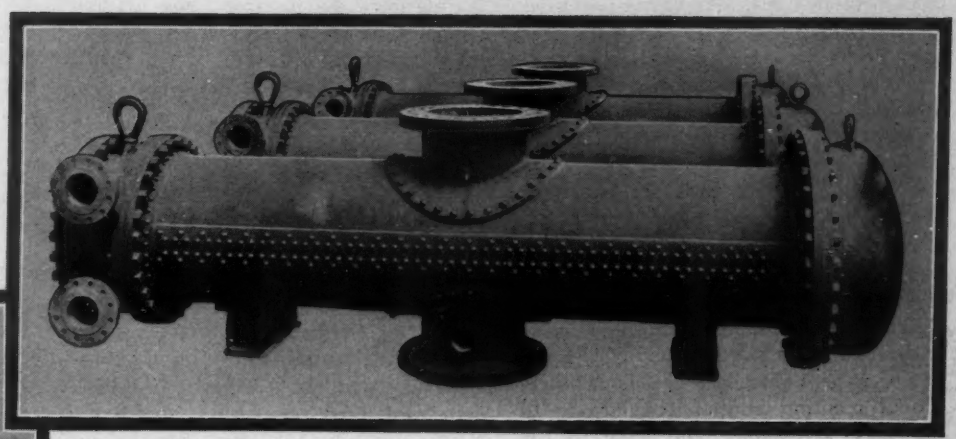
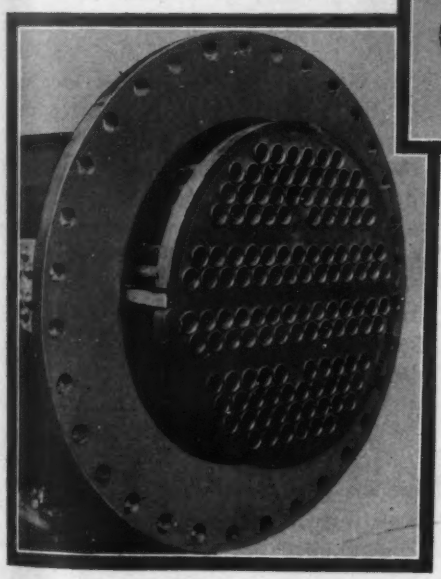
Westinghouse partial condensers, equipped with condensate collecting well in the outlet nozzle opening





Showing the internal rail for facilitating removal and insertion of tube bundles, and axially supporting the floating head. This rail also makes the baffle seal more positive

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Since the crude has a tendency to deposit residue, the tubes are made of sufficient diameter to facilitate frequent mechanical cleaning. The separate cover on the tube channel also makes tube cleaning easy.

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A.S.T.M. Committees Consider Motor Fuels and Lubricants

THE annual spring group meeting of committees of the American Society for Testing Materials held in Detroit, March 17-21, marked a departure from past methods of group meetings in this organization in that 23 committees held their sessions over a period of five days. This plan has worked out very successfully as it proved to conserve the time and expense of members serving on a number of committees, to give the 500 men in attendance opportunity to get better acquainted, and to discuss their mutual problems. The committees met throughout all five days, starting with sessions in the morning and extending through the afternoon and evenings with but one break, a dinner on Wednesday evening.

The group meeting was held in conjunction with the Detroit regional meeting, a meeting arranged by the Detroit district committee comprising two technical sessions at which a number of papers were presented. The regional meeting contributed largely to the high attendance and gave to the meetings an atmosphere of a general meeting of the society. Over 700 were present at the dinner including a number of guests from the local sections of the Society of Automotive Engineers, the American Society for Steel Treating, and the National Association of Purchasing Agents. The dinner was followed by a demonstration of audible light by J. B. Taylor of the General Electric Company. In all, 23 committees of the A.S.T.M. took part in the sessions, but with the many sub-committee meetings that were necessary the number of meetings held during the five days totalled approximately 125.

At the meeting March 18 of committee D-2 on petroleum products and lubricants it was agreed to recommend to the society for adoption as a tentative standard, the Reid method for the determination of the vapor pressure of natural gasoline, and a new method of test for the dilution of crack case oil. The Reid method of vapor pressure determination has also been adopted by the Interstate Commerce Commission and the Natural Gasoline Association of America as the official method to be used in determining the classification of gasoline for purpose of transportation.

A number of tentative methods were revised, some standard methods were subjected to revision, and several tentative methods of testing were advanced to standard methods, and several tentative revisions were adopted as standard. Final action by the society on such recommended changes will not be taken until the annual meeting in June.

Committee D-2 has initiated its specification work actively through the appointment of three technical committees. Technical committee A on gasoline held its organization meeting on March 18. The officers are H. L. Horning, Waukesha Motors Company, chairman; C. B. Veal, Society of Automotive Engineers, vice chairman; and Dr. T. G. Delbridge, The Atlantic Refining Company, secretary. As a result of the discussion, sub-committees on various topics, including gum formation, corrosion, and vapor-locking, were appointed .

There was also a meeting of technical committee B on motor oils, whose officers are as follows: H. C. Mougey, General Motors Corporation, chairman, and T. G. Detwilder, The Texas Company, secretary. The sub-committees of this technical committee cover the topics of viscosity, pour point, service changes, carbon formation and oil consumption.

The organization meeting of technical committee C on fuel oils, including Diesel fuels, which is to function also as a sectional committee under the procedure of the American Standards Association, resulted in the election of Lee Schneitter, Electric Bond & Share Corp, as chairman, and A. E. Flowers, the De Laval Separator Company, as secretary. Two main sub-committees were appointed, a sub-committee on domestic and industrial fuel oils with Commander C. C. Ross of the U. S. Navy as chairman and H. F. Tapp, American Oil Burner Association, as secretary; and the sub-committee on Diesel fuels with L. H. Morrison of power as chairman and W. H. Butler, Standard Oil Co. of New Jersey, as secretary.

Committee D-2 on petroleum products and lubricants is headed by F. A. Hull, Chief Chemists' Testing Laboratory, General Electric Company, Schenectady, N. Y., as chairman and Dr. R. P. Anderson, technologist, American Petroleum Institute, New York City, as secretary.

The thirty-third annual meeting of the American Society for Testing Materials will be held this year at Chalfonte-Haddon Hall, Atlantic City, N. J., June 23 to 27. It has also been announced that the annual meeting in 1931 will be held at Chicago.

Among the papers presented and of interest to the refining industry was "The Significance of Tests for Motor Fuels," by R. E. Wilson, head, Development of Patent Department, Standard Oil Company (Indiana). This paper discusses the significance of the various tests for motor fuels, particularly in the light of extensive research along these lines during the past few years by oil company and the automobile company laboratories, and the Bureau of Standards. While the general public still seems to assure that the principle difference between different grades of gasoline is in mileage, actually the differences in the mileage obtainable on the best and the poorest of commercial gasolines of today are small compared to the engine and fuel induction system.

Volatility is the most important single property of a motor fuel. Recent research has demonstrated that the 10 per cent point on the A.S.T.M. distillation curve is the best measure of the ease of starting in cold weather and of the danger of gas lock, while the 90 per cent point is the best measure of the ease of uniform distribution and lack of crank case dilution in an engine after it has warmed up. Other intermediate points are of some importance in determining the ease of acceleration, especially while the engine is being warmed up, but in general proper limits on the 10 per cent point, 50 per cent point and 90 per cent point of a fuel will insure good performance under all conditions so far as fuel volatility is concerned.

Antiknock quality is the next most important property of a gasoline from the standpoint of performance. Actual engine tests under carefully controlled conditions are as yet the only reliable measure of the engine.

Sulphur content, gum content, and freedom from corrosive substances are of importance in determining whether a gasoline can be used steadily without corroding or clogging the fuel induction system. Other properties of gasoline have little or no influence affecting the performance of a motor fuel, except that variations in viscosity or gravity may necessitate the readjustment of the carburetor to give best results. High volatility and antiknock properties, and low sulphur and gum content all cost money to obtain, and frequently by proper design the automotive engineer can decrease the need

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Weight 250,000 lbs.
Handled and shipped in one piece

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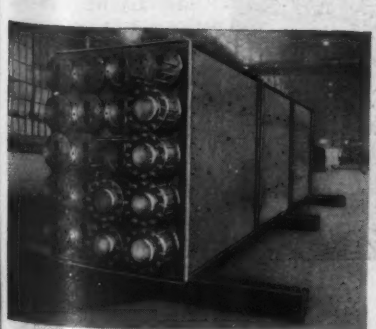

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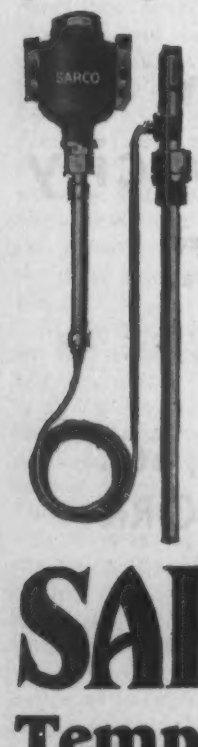
The Sarco Temperature Regulator automatically maintains any given temperature. It never forgets or gets tired.



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In his paper, "The Significant Properties of Automotive Lubricants," H. C. Mougey, assistant technical director, Research Laboratories, General Motors Corporation, states, "The mysterious thing called 'quality' in a lubricating oil is not a definite thing. Quality consists simply in the possession of those properties which make an oil perform well in the particular kind of service to which it is applied. Any one of the various properties of oils, such as viscosity, rate of change of viscosity with temperature, congealing point, volatility, oiliness and the like, may become a measure of quality of an oil if the given property is of effect in the particular use to which the oil is put. Tests that give a measure of quality must therefore be related to service; and, since conditions of service vary over such a wide range, a property that is desirable in an oil for one use may be of less value for another use."

The oil tests developed by committee D-2 of the A.S.T.M. are not direct measures of quality for the most part, but may be used to estimate quality for a definite use. There is a further problem of making still more specific interpretation of oil tests with respect to their relationship to performance in service. The effects of some of the principle properties of lubricants upon how they perform in service are discussed in detail.

Stratford Engineering Company, petroleum refining engineers, Kansas City, announces the appointment of W. R. Layne as sales manager for the Mid-Continent territory with offices in Tulsa. Mr. Layne was for a period of years pump specialist for the manufacturing department of Standard Oil Company of California. For several years he was chief oil pump engineer with the Byron Jackson Company, covering special engineering problems of the oil industry over the United States. Mr. Layne comes to Stratford Engineering Company from his recent position as Houston sales manager for the same company. Many years experience in special refining engineering work, as well as his wide acquaintance in the industry, have especially fitted him for the duties of his new connection.

W. R. LAYNE

Refinery and Gasoline Plant Activities

New Plants – Construction Notes – Personnel Changes

Amarillo P. & R. Resumes

Amarillo Producers and Refiners Corporation has completed minor repairs at its Pyote, Texas, plant and has resumed operations. Operations last summer were terminated upon expiration of crude oil contracts with Texon Oil and Land Company when it was taken over by Continental Oil Company. A new crude contract has been made with American Petroleum Company, Houston, and oil will be piped to the Pyote plant at the rate of 1500 to 2000 barrels daily.

The company's Amarillo office has been closed and general offices for both Amarillo Producers and Refiners Corporation and Del Rio Refining Company, which operates a 3000-barrel plant, will be maintained at Del Rio, Texas.

J. D. Wrather is president of both companies as well as Michigan Central Refining Company, Muskegon, Michigan. P. H. Hertzog is vice-president and in charge of sales and traffic. John Wrather, son of the president, is in charge of operations of both Texas refineries.

Montana Plant Goes on Continuous Schedule

Arro Oil & Refining Company, Lewiston, Montana, which has been operating but 10 days each month for the past 10 months started continuous operations April 1. The plant has a capacity of 2000 barrels daily.

Associated Oil Company to Build Refinery in Japan

Associated Oil Company, one of the principle subsidiaries of the Tide Water Associated Oil Company, has joined with the Mitsubishi interests of Japan for the purpose of manufacturing and distributing petroleum products in Japan, according to a statement issued by William F. Humphrey, president.

Mitsubishi Oil Company, Ltd. is being organized for the purpose of carrying on such operations. Under the supervision of engineers with the Associated Oil Company, this former company will start construction of a modern refinery at an early date and with the view to completing construction this year. Land has been purchased for a refinery site at Tsurumi, on Tokyo Bay between Tokyo and Yokohama. According to present plans the plant will be a complete modern refining unit with a capacity of 4000 barrels daily and a cracking capacity of 1500 barrels. The refinery will be equipped to produce gasoline, distillates, kerosene, lubricating oils, fuel oil and other petroleum products which will be marketed in the empire of Japan, in Korea, Formosa, and other sections of the Orient. Crude requirements for the refinery will be furnished by Associated Oil Company from its California production.

Barber Asphalt Builds New Laboratory

The Barber Asphalt Company, Maurer, Perth Amboy, New York, a subsidiary of the General Asphalt Company, is erecting a new laboratory, both research and routine, and engineering building at its local plant. The building will be two story, and basement, and estimated cost is placed at $125,000.

Barnsdall Installing Cross Unit

A new Cross model-A cracking unit is being installed by M. W. Kellog Company at the Okmulgee, Oklahoma, refinery of the Barnsdall Refineries, Inc. The new unit is to replace an old Cross unit, and will be used to manufacture superethyl gasoline for the company. New boilers for the plant are also being installed. Water wells are being drilled adjacent for supplying the refinery with additional water.

Beacon Changes Name

Beacon Oil Company, a subsidiary of the Standard Oil Company of New Jersey, has announced a change in its firm name to Colonial Beacon Oil Company. Stockholders of the company ratified the change of name at their annual meeting early in April. This change brings into the firm name the "Colonial" trade mark under which its products are marketed.

Canadian Refinery

Canadian Oil Company, C. A. Hale, general manager, Petrolia, Ontario, plans the construction of a small refinery at this place at an estimated cost of $500,000, and which will be equipped to produce high test gasoline, according to an item appearing in Chem. & Met. Eng. Capacity is not reported.

Cities Service Rumored Planning Line to Houston

Construction of approximately 500 miles of 12-inch line from the Oklahoma City field to a refinery site on the Houston Ship Channel is reported to be contemplated by the Henry L. Doherty interests to provide an adequate market for the large potential oil production offered by Indian Territory Illuminating Oil Company. The latter is the discoverer and major developer of the Oklahoma City field, and is a subsidiary of the Empire Gas & Fuel Company of Delaware.

A direct route from Oklahoma City via Gainesville, and Corsicana to a point near Houston would be followed in the construction of this crude transportation system. An aerial survey of the route is reported to have been completed. Empire Oil & Refining Company is operating a skimming and cracking plant at Gainesville, Texas, and receiving its crude supply via a small line from fields in South Oklahoma and the Texas Panhandle in tank cars.

The proposed refinery site on the Houston Ship Channel is reported to be below the plant recently completed by Shell Petroleum Corporation and near San Jacinto Battle Ground. An initial installation for the processing of 20,000 barrels of crude daily is credited with being on the refinery schedule. The surplus crude brought to the Gulf Coast above local refinery requirements would be made available for the Cities Service Refinery Company's 15,000-barrel plant at East Braintree, Massachusetts. The latter concern is also owned by the Henry L. Doherty interests, and has been a major purchaser of crude in tanker lots from marketing companies on the Texas Gulf Coast and California points.

New Oklahoma Gasoline Plant

Crosbie & Moran, Inc. are now constructing an absorption type natural gasoline plant with a rated capacity of 20,000 gallons daily in Section 8-6-6, south of Seminole, Oklahoma, in the Kanawa pool. Operation is scheduled to start early in April. Tulsa type equipment is being used in general processing. The same company is operating two plants in the Earlsboro pool, Seminole area and one in Logan County, Oklahoma.

Deep Rock Oil Corporation

Shaffer Oil & Refining Company, Tulsa, Oklahoma, has announced through its president, John L. Gray, that effective April 1, the company name will be changed to Deep Rock Oil Corporation. This change affects subsidiaries of the company including Home Oil Company (operating in Minnesota, North Dakota, and South Dakota) the High Test Oil Corporation of Oklahoma and Arkansas, and the Deep Rock Oil Company of Wisconsin and Michigan. Approval of the change in name was made at a meeting of stockholders of Shaffer Oil & Refining Company, March 20, at which meeting all directors of the company were re-elected.

Increasing Filtering Capacity

Oil Creek Refining Company at Titusville, Pennsylvania, is installing additional filtering equipment to double the capacity of the filtration plant. The refinery with a capacity of 1200 barrels daily, is a com-

plete plant producing a full line of automotive and industrial lubricants as well as neutrals and bright stock. F. J. McGraw is in charge of refinery operations.

Empire Building in Seminole Area

Empire Oil & Refining Company is building a 14,000-gallon oil absorption natural gasoline plant in the Greater Seminole area, which is to be completed and placed in operation this month. The plant location is Section 9-6-6.

Canary Island Refinery Reported

The Espanola de Petroleos is reported to have signed contract with an American company for the construction of a petroleum refinery at Teneriffe, Canary Islands, which is estimated to cost $1,250,000 and to have a rated capacity of 5000 barrels. Construction is to begin immediately. The same company which controls oil lands in Venezuela, South America, and has recently made arrangements with the monopoly with part of its requirements, has offered 40,000 50-peseta shares to effect an increase in capital. This has been underwritten by Spanish banks headed by Banco Exterior de Espana.

F. C. Henderson Corporation Building in Panhandle

The F. C. Henderson Corporation, Tulsa, Oklahoma, is completing construction of a 14,000-gallon absorption type natural gasoline plant in Survey 82, Block 46, Y. & T. C. R.R. Survey, Hutchinson County, Texas. This installation is adjacent to the townsite of Sanford, Texas.

New Billings Plant to Start in April

Billings, Montana.—Laurel Oil & Refining Company is putting the finishing touches on its plant here. It will be ready to start fires under the stills early in April. The plant will run almost entirely on crude from the Oregon Basin field, Wyoming. The refinery is the last word in construction and will cost about $1,000,000. It has a charging capacity of 1600 barrels.

McKean County Refining Company Enlarging

McKean County Refining Company, recently purchased by The Pennzoil Company, Oil City, Pennsylvania, at its refinery at Farmers Valley, Pennsylvania, has awarded contract for the construction of a group of buildings including a two story, 50 by 120 feet barrel house, a one story 65 by 72 feet, wax house, new boiler house of 400 horsepower capacity; a coal handling building of 300-ton capacity; a burner building and 12 filters; a shop building, and an office building. Work is to start immediately.

Magnolia Not to Build at Sweetwater

Magnolia Petroleum Company has semi-officially denied reports that it was considering the construction of a refinery to be located at Sweetwater, Texas, and which was reported to be contemplated at a cost of $4,000,000.

Magnolia Completing Gray County Plant

Magnolia Petroleum Company, in Section 30, Block B2, H. & G. N. R.R. Survey, Gray County, Texas, is completing the construction of an absorption type natural gasoline plant recently acquired from the White Eagle Oil & Refining Company. When the White Eagle organization was taken over by the Standard Oil Company of New York, the Magnolia Petroleum Company took over all of its Texas operations. The gasoline plant has a rated capacity of 10,000 gallons daily.

Old Dutch Refining Company Resumes

The Old Dutch Refining Company has resumed operations at its Muskegon, Michigan, refinery after installation of two new 500-barrel shell stills and making other minor changes and improvements. The plant is specializing in the preparation of special naphthas, employing tube still and shell still operation, and is running crude at the rate of about 2000 barrels daily.

John Borden is now president of the company, following the resignation of W. E. Anderson. Mr. Borden has announced that F. H. Duggan and N. Buining, have been appointed secretary and treasurer, respectively. Ernest L. Hughes of Hughes Oil Company, Chicago, continues as vice-president of the company and is general manager of the Muskegon plant. E. G. Guy continues as plant superintendent.

Pampa Refinery Operating

Petroleum Refractionating Corporation, affiliated with Bell Oil & Gas Company, Tulsa, began operating its newly erected refinery at Pampa, Texas, March 13. The Pampa plant will operate at its capacity of 4000 barrels daily. It is planned to install cracking units later. Sweet crude of 40/42 A. P. I. gravity is being processed at Pampa. Bell Oil & Gas Company operates a 4500-barrel refinery at Grandfield, Oklahoma. Rex Young is superintendent and Mark Finston is general manager for both plants.

Phillips Acquires Two Gasoline Plants

Phillips Petroleum Company has purchased two natural gasoline plants in the Burbank field, Osage County, Oklahoma. In Section 31-27-6, one of the plants purchased was formerly operated under the name Romarti Gasoline Company and was owned by Continental Oil Company, Shell Petroleum Corporation and Tidal Oil Company, who have been joint operators of the installation for the past three years. The rated capacity was 10,000 gallons daily.

The second plant purchased was a 1000-gallon unit operated by Mid-Kansas Oil & Gas Company. Phillips Petroleum Company will dismantle both plants and will process the gas thus made available through its plant in the Burbank field. This acquisition adds 2500 acres to the company gas producing properties.

Refinery Completed in Belgium

Raffinerie National des Petroles, S. A. of Brussels, Belgium, has completed construction of its refinery at Selzaete, near Ghent. Work has been in progress for nearly a year, according to an item in Petroleum Times, February 15, 1930. The capacity of this plant is reported as 6,500,000 gallons of motor spirit and 15,000 tons of mazout (residual fuel oil) per year. Wharfs are provided for the unloading of crude oil, which is shipped to the plant by tanker from the "La Territorial" concession in Mexico of the Anglo-Belgian Petroleum Company, Ltd.

Crystal Plant Temporarily Shut Down

J. H. Riedemann, general manager of the Crystal Oil Refining Corporation, announced recently that plans have been made to close down the company's refinery at Cedar Grove, a suburb, about April 1, in order to enable officials of the company to consider plans for extensive alterations, additions, and improvements, which were recently drawn by a group of Chicago engineers.

This move, it was also pointed out by Mr. Riedemann, will be in line with the plan of the oil industry to curtail operations and expedite the disposal of surplus stocks.

Ample arrangements have been made to enable the company to take care of all its customers and contracts pending the resumption of refining operations, the date for which was not indicated.

Rotary Process Plant Building

Rotary Process Refining Company, 850 Subway Terminal building, Los Angeles, is progressing rapidly in the construction of its plant at Downey, California, near the refinery of the Rio Grande Oil Company. The new company recently awarded contract to Engineering Research and Equipment Company for construction of a part of its refinery. T. E. Elliott, of Elliott Core Drilling Company is president of the Rotary Process Refining Company, F. C. Merritt is vice-president and H. W. Parmelee, secretary. This system employs the Norris Goodman and R. W. Poindexter process using rotating reaction chambers. The plant has a rated capacity of 1000 barrels daily.

New Shell Refinery Proposed

Shell Eastern Petroleum Products Company, 122 East 42 St., New York, a subsidiary of the Shell Union Oil Company, St. Louis, is reported to be planning the construction of a new oil refinery at its

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What's the idea of buying those new Lincoln gas engine driven welders—and why the Lincoln?

When you seem bent on spending—how are we going to save any money?"

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By spending it this way.

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—welds easier
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—permits greater output because of the steady uniform arc throughout entire welding range, which is the result of:

- **Variable voltage design**
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No other welder has all these features.

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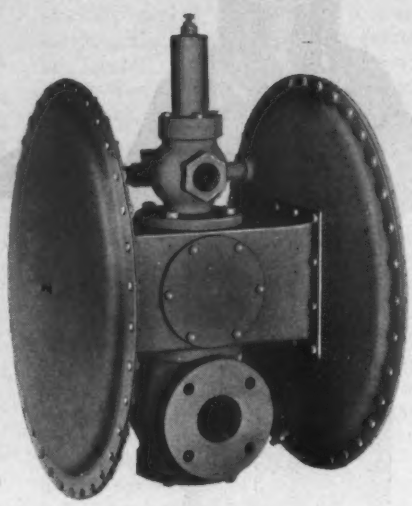
THE WILCO DUPLEX TANK CONTROL will hold practically constant pressure on storage tanks, flow tanks, and rundown tanks, during periods of loading or unloading, and expansion or contraction of gas in the tank, while at the same time allowing wet gas to be drawn out by the compressor, and eliminates all fire hazard due to admixture of air in tank or compressor plant.

This regulator allows dry gas to enter tank to prevent a vacuum being formed when tank would otherwise take in air through vent valves.

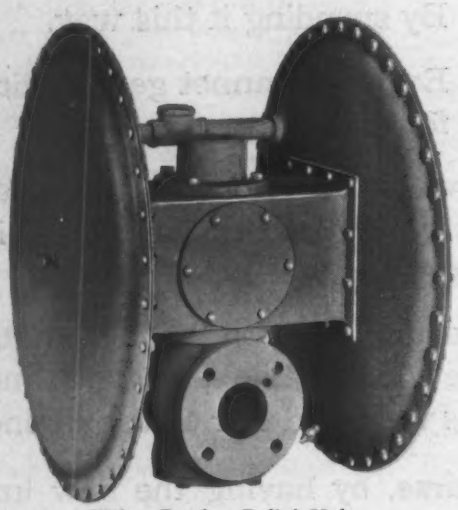
Atmospheric pressure may be maintained within three tenths of an inch of water.

Built in all sizes up to six inch of Cast Iron or Stainless Steel trimmed.

Easy of access for cleaning. Sensitive and simple.



Wilco Duplex Tank Control



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Both the Wilco Duplex Tank Control and the Wilco Duplex Relief Valve have been designed for corrosive gas condition.

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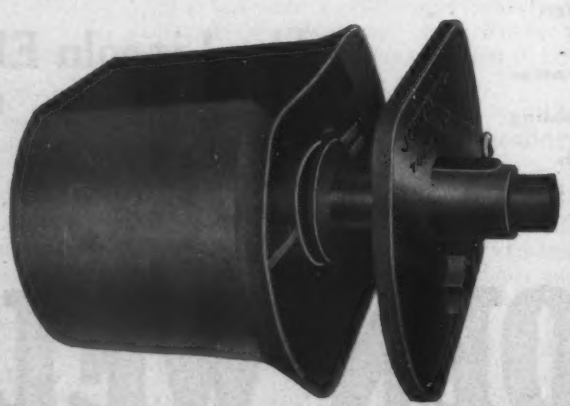

property at Sewaren, New Jersey. This property is now used in part as a bulk distributing plant. The refinery will consist of several units and is estimated to cost about $700,000, including machinery.

Restoring California's First Refinery

Standard Oil Company of California plans to restore the old refinery built in 1875 in Railroad Canyon, which, so far as is known, is the first refinery to be erected on the West Coast. The remaining ruins will be cleaned and repaired and parts rebuilt so that the reconstructed plant will appear as nearly like the original installation as possible. The plant and surrounding grounds will then be fenced and converted into a park. In this manner a most interesting relic will be preserved for the future.

Sweden's First Petroleum Refinery

Sweden's first oil refinery is nearing completion near Nyashamm, about 40 miles southeast of Stockholm. This small plant is being erected for Messrs. A. Johnson & Company, Stockholm, owners of the shipping company operating the Johnson Line. Located on the shore of the Baltic the refinery has facilities for tankers, and it is the intention of the operators to produce a full line of petroleum products for domestic sale and export to neighboring markets, according to The Petroleum Times, London.

Coleman County, Texas, Gasoline Plant

Texas American Syndicate, Dallas, is erecting a one-unit well pressure absorption type natural gasoline plant on the Nannie Newton farm on the San Augustine Survey, Coleman County, Texas. Rated capacity of the unit is 10,000,000 cubic feet of gas daily, and it is designed to operate at 300 pounds pressure. Rock pressure in this area is reported at 1400 pounds, and the natural gas is said to yield five gallons per 1000 cubic feet. The company owns in fee or has leases on 14,300 acres around and including the Newton property. Oklahoma Natural Gas Company is taking the residue gas from the plant.

Texas Company Buys Gasoline Plant

The Texas Company recently purchased the small compression type natural gasoline plant of the Continental Oil Company located on the Waggoner ranch, near Electra, Wichita County, Texas. This plant will be dismantled and the gas treated through another Texas Company plant operating one-half mile northwest of Electra which has a rated capacity of 13,000 to 15,000 gallons daily.

New Refinery in Dallas

Texas Eagleford Oil & Refining Company has completed construction and started operating its 1000-barrel skimming plant in West Dallas, Texas, and is pro-

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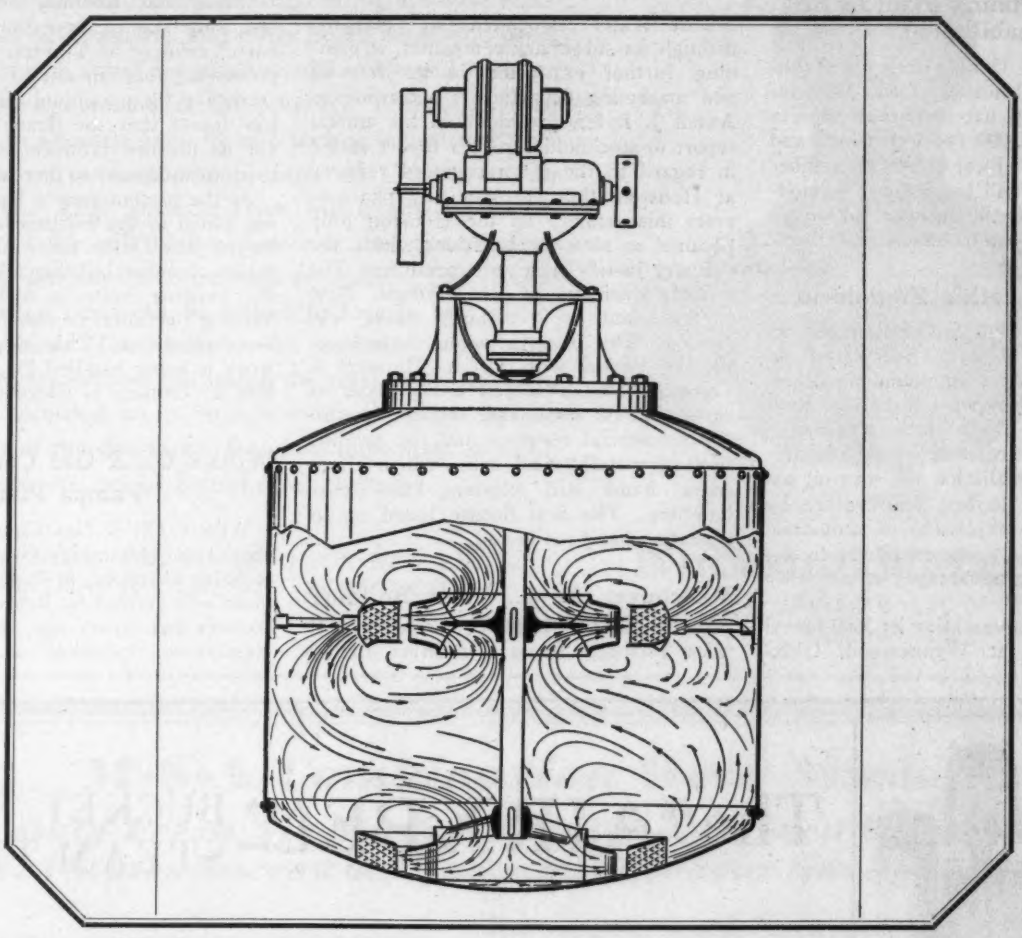

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cessing tops shipped by rail from West Texas points. The products are marketed locally through 12 service stations of Everybodys Oil & Gas Company at Dallas. Part of the equipment was moved from an old refinery at Greenville, Texas. Dan Robinwitz is president of the company, Robert Knight is vice-president and general manager, and J. K. Whitehead is secretary and treasurer.

Utah Oil Refining Plant to Be Rehabilitated

Salt Lake City, Utah.—Utah Oil Refining Company, subsidiary of the Midwest Refining Company, has authorized the expenditure of $150,000 for extensions and betterments to its local plant. A number of obsolete stills will be replaced by modern equipment for the recovery of larger yields from crude petroleum.

New Refrigerating Equipment

Texas Pacific Coal & Oil Company at its Fort Worth plant has completed the installation of direct ammonia expansion refrigeration facilities for the preparation of low cold test bright stocks and motor oils, doubling the capacity of this department. In this installation the wax-oil solution is chilled to low temperature by means of direct expansion of ammonia. Research work is being continued to determine operating advantages of wax free lubricants.

The company is operating its 3500-barrel skimming plant at Wynnewood, Oklahoma, with H. H. Pratt as superintendent. George Pfau is superintendent of operations at the 3000-barrel complete refinery at Fort Worth, and R. Seibel is in charge of operations at the 1000-barrel topping plant in operation at Caddo, Texas. Dr. E. R. Lederer is vice-president and general manager of manufacturing.

Tide Water Company Plans Expansion

Tide Water Associated Oil Company, through its subsidiary companies, is planning further expansion in its refining and marketing departments according to Axtell J. Byles, president, in his annual report to stockholders. This report stated in regard to the often rumored refinery at Houston, that the company plans to erect this refinery on the Houston Ship Channel as soon as conditions within the industry justify such an expenditure. The refining facilities at its Bayonne, New Jersey, plant are constantly being expanded. The manufacturing department in cooperation with H. A. Brassert & Company has developed a new type of equipment for the coking and cracking of noncommercial residues and the production of metallurgical coke, which eliminates hand still cleaning and coke handling. The first license based on its operation has been issued.

Vancouver, B. C., Plant Building

Seaboard Oil Refining Company, 510 West Hastings Street, Vancouver, British Columbia, has awarded contract for the first unit of this new Canadian refinery; bulkheading and fill required for wharfs, clearing site, preparations for foundations for a number of steel tanks and for refinery buildings. Estimated cost of the plant is $2,000,000.

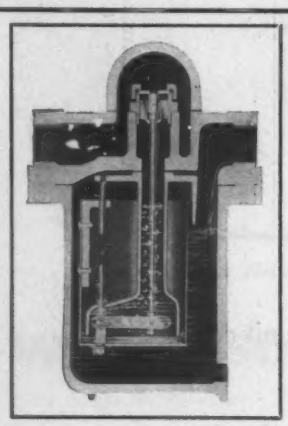
White Star Refinery Adding Dubbs Unit

White Star Refining Company, which last July started operation of its 6000-barrel refinery at Trenton, Michigan, for processing this amount of Mid-Continent crude for the maximum yield of gasoline, has found that the demand and market for its finished products is so great that it is advantageous to increase the capacity.

At the present time a Dubbs unit is being added to the existing battery, consisting of two Dubbs units, and another reaction chamber is being added to each of the existing units in order that either flashing operation or running to coke can be carried on. This new construction work is being handled by Arthur G. McKee & Company of Cleveland.

Wilcox Oil & Gas Company Buys Pampa Plant

Wilcox Oil & Gas Company has purchased the skimming plant of the Pampa Refining Company, at Pampa, Texas. This plant was erected by Reese Allen and associates two years ago and has been in continuous operation since, using the



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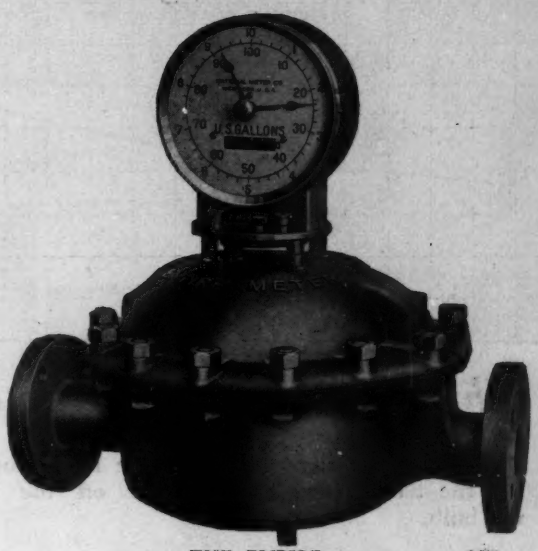

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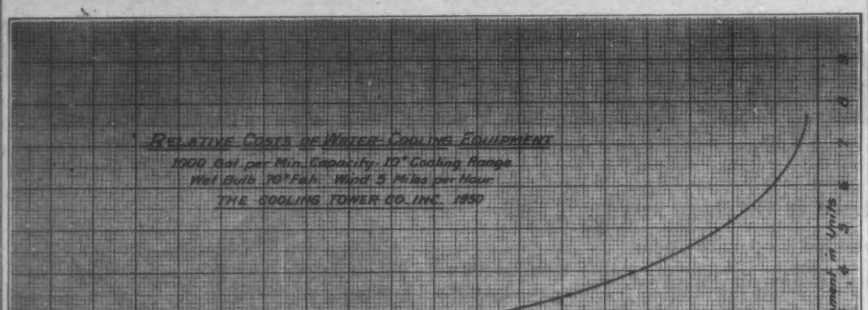
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Rowsey system of distillation and treatment. The refinery has a capacity of 3000 barrels daily and is operated at this figure processing oil produced on the purchasing company's properties. It is reported that cracking equipment may be installed later.

Wilcox Oil & Gas Company has a second refinery at Bristow, Oklahoma, with a capacity rating of 4000 barrels and Dubbs cracking equipment. P. I. Tinkler is in charge of refinery operations.

Hydrogenation Process Will Be Licensed

Standard Oil Company of New Jersey will license its hydrogenation process to all oil companies that can commercially use it, according to recent announcement. A separate company is being organized to take over the rights to the process in the United States from the Standard I. G. Company, which is owned jointly by the Standard Oil Company of New Jersey and the German I. G. Farbeindustrie. American companies wishing to utilize the hydrogenation process for the synthesis of motor fuels and lubricants will be required to subscribe to stock in the new company and pay a nominal royalty, the new company in turn paying royalty to the Standard I. G. Company for the United States rights to the process.

Standard Oil Company of New Jersey is at present constructing a hydrogenation plant at its Bayway refinery and expects to have the process in operation during the early summer. A similar plant is to be operated at the Baton Rouge, Louisiana, plant of the Standard Oil Company of Louisiana by the close of this year. A third hydrogenation plant at the Baytown, Texas, plant of the Humble Oil & Refining Company is under construction and a fourth hydrogenation plant is being erected by the Imperial Oil Company, Ltd. at Sarnia, Ontario.

Kendall Promoted at Sinclair Houston Refinery

Sinclair Refining Company, at its Houston refinery announced April 1 that Parker Kendall has been promoted to superintendent of refinery operations succeeding J. W. Duckett, who has been transferred to New York.

For the past 10 years Mr. Kendall has been engaged in refinery work at the Houston plant to which he was transferred from the East Chicago refinery after three years service there. In Houston Mr. Kendall has worked as chief clerk, foreman of stills, night superintendent, and assistant superintendent. He has been acting superintendent of the Houston plant since February and this promotion was confirmed by George H. Tabor, Jr. on April 1.

Harry L. Pelzer has been transfered from the East Chicago refinery from the technical department and has been appointed assistant superintendent of the Houston plant. W. Johnson has been named general refinery foreman.

New Equipment for the Modern Plant

First Aid Kit

BULLARD-DAVIS, INC.

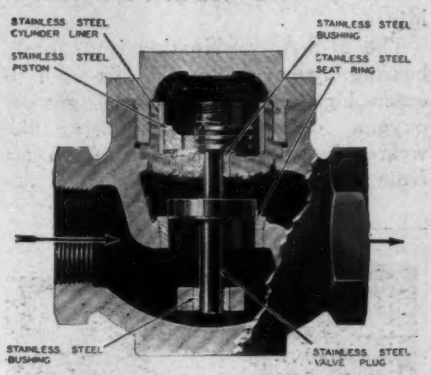
Bullard-Davis, Inc., announce their appointment by Standard Oil Company of California as licensed manufacturers of that company's patented aluminum first aid kit, to be placed on the market under the name Bullard cylindrical first aid kit. It is, as its name implies, cylindrical in shape and is made of drawn aluminum, and can be conveniently mounted on a wall, and making an ideal kit for trucks or any kind of motor vehicles. The kit is designed to be durable, dustproof, waterproof, noncorrosive, and non-tarnishing.

Within the Bullard cylindrical kit the first aid material is kept in unit packages rolled in a durable duck roll-up, easily removed from the kit so it can be carried conveniently to the injured. The visibility of the kit's contents and the simplicity of removing the desired units are to eliminate the necessity of fumbling in time of excitement. The roll-ups may be conveniently carried from place to place.

New First Aid Kit

Check Valve

NEILAN, SCHUMACHER & COMPANY



Neilan, Schumacher & Company, 641-651 Santa Fe Avenue, Los Angeles, have placed on the market a new hydraulic double cushioned noiseless check valve to withstand the work of corrosive sulphur gases in crude oil.

The valve plug, valve seat, valve piston, cylinder liner and guide bushings have been turned from solid stainless steel bar stock of high quality.

The hydraulic double cushioning principle employed serves to make the valve noiseless. It is designed and constructed to operate on working pressures up to 1500 pounds. Prolonged laboratory and field tests have been conducted in perfecting this new check valve.

Bulletin No. 518-C, giving an illustrated description of the valve, may be obtained by writing the manufacturers.

Master Switch

ELECTRIC CONTROLLER & MANUFACTURING COMPANY

Electric Controller & Manufacturing Company, Cleveland, is now manufacturing a new master switch, Type NT, the function of which is to regulate the control circuits of a magnetic contactor controller. This switch is intended for use on many applications where full speed control from the master switch is desired.

Use of ball bearings, the short throw of the operating handle, the absence of gears and the fact that the contact fingers always ride on uninterrupted plane surface offers an almost frictionless operation of the Type NT master switch. An improved roller type centering device rides on a notched track, also contributing toward noiseless operation.

This switch is entirely enclosed by heavy gauge steel cover and is arranged for conduit connection. Both the contacts and contact fingers are of a greatly improved design and are easily renewable.

It is built to give a maximum of six points of speed control in each direction with overload reset at the off position. Master switches for four, five or six points of speed control are identical, the only difference being the location of the arm stops. Since these stops are merely screwed into the main frame, they may be changed in the field to provide any one of these number of points of speed control, thereby reducing the spare part problem.

Electric Controller Master Switch

New Type Return Bend

STOCKHAM PIPE & FITTINGS COMPANY

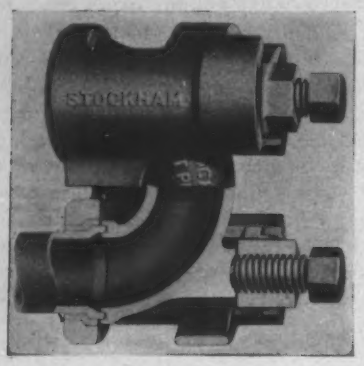
Stockham-Fantz Type return bend does not require expanded end tubes. There is no rolling in or other preparation at the tube bank, for the tubes employed can be furnished all ready for use by any tube mill. Insertion of tubes is a simple matter of assembly and any individual tube may be as easily removed for cleaning or inspection.

Because in assembly or dismantling there is no possible damage to the tube ends, it is apparent that tube expense will be reduced. The simple assembly makes possible the efficient use of special alloy tubes.

The yoke and U bend are separate units—there is no excess weight in the yoke assembly but there is ample strength. The U piece is the only part which comes in contact with hot oil

and while the smooth stream-like flow reduces friction and keeps the bend free from coke, the U piece can easily be replaced without requiring a new yoke.

Simple devices have been developed



Stockham Return Bend

to insure ease of operation. A wrench for the toggle bolt, protectors for tube ends to prevent slight scoring, tongs to make handling easy.

The Stockham Pipe & Fittings Company of Birmingham, Alabama, make the bend for any specifications for pressure, temperature, tube diameter and tube spacing.

Stockham Return Bend

Alloys

Downington Iron Works, Downington, Pennsylvania, has recently issued an interesting booklet entitled "Corrosion Resistant Alloys in General Fabrication." This booklet is written by T. Holland Nelson, consultant metallurgist for Downington Iron Works, and will be sent anyone interested.

Hose Mask

MINE SAFETY APPLIANCE COMPANY

Mine Safety Appliances Company, Pittsburgh, announces the official approval of the M-S-A combination hose mask and a permissible canister for protection against acid gases and organic vapors for M-S-A tank gaugers' masks by the United States Bureau of Mines.

The M-S-A combination hose mask, bearing approval No. 1901, is used to enter high concentrations of gas or oxygen deficient atmospheres, the wearer being supplied with fresh air from the outside. The mask is designed for safe use with as much as 150 feet of hose.

Cannister

Hose Mask

The M-S-A tank gaugers' mask is approved for protection against acid gases and organic vapors and is of special importance to the oil industry becauseo f the protection it affords against deadly hydrogen-sulphide gas from sour crudes and distillates.

Literature on either or both types of masks will be gladly furnished upon request.

Control Instruments

BROWN INSTRUMENT COMPANY

Brown Instrument Company has just published Catalog No. 7501, covering Brown remote type instruments. The catalog is 32 pages and fully illustrated in two colors throughout, the illustrations showing in detail how the various instruments operate. Sectional views and wiring diagrams amplify the descriptive material.

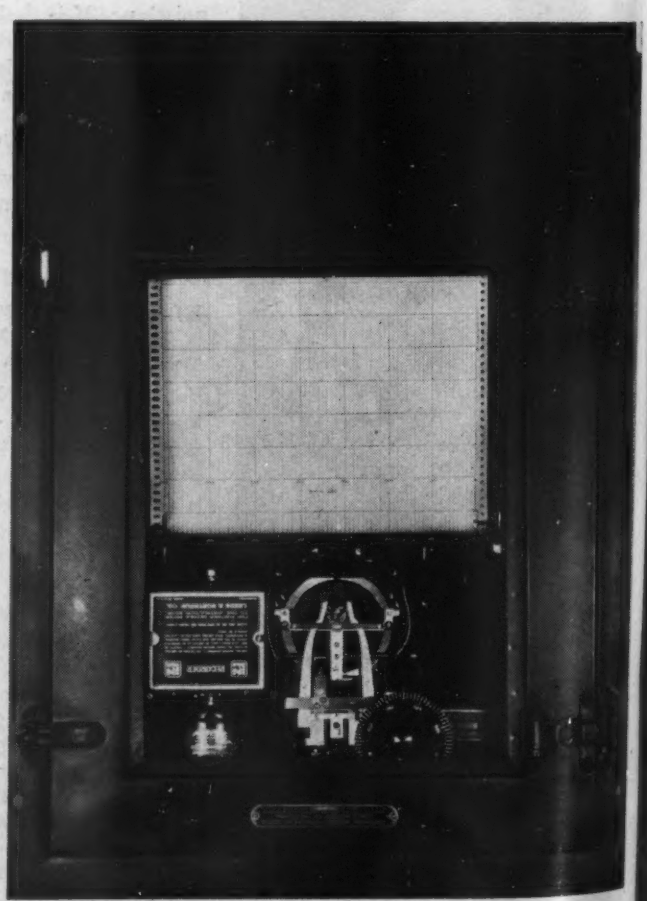
The remote type instruments described now furnish needed data instantly and accurately from distances of a few hundred feet up to 30 miles. They are furnished in models respectively designed to control, record and indicate flows, pressures, liquid levels and positions. They are also supplied in indicating or recording models equipped to operate light signals or sound an alarm when predetermined limits of the governing factor are reached. Either circular chart or strip chart recorders are available.

Copies of this new catalog may be secured from the Brown Instrument Company, Philadelphia, upon request.

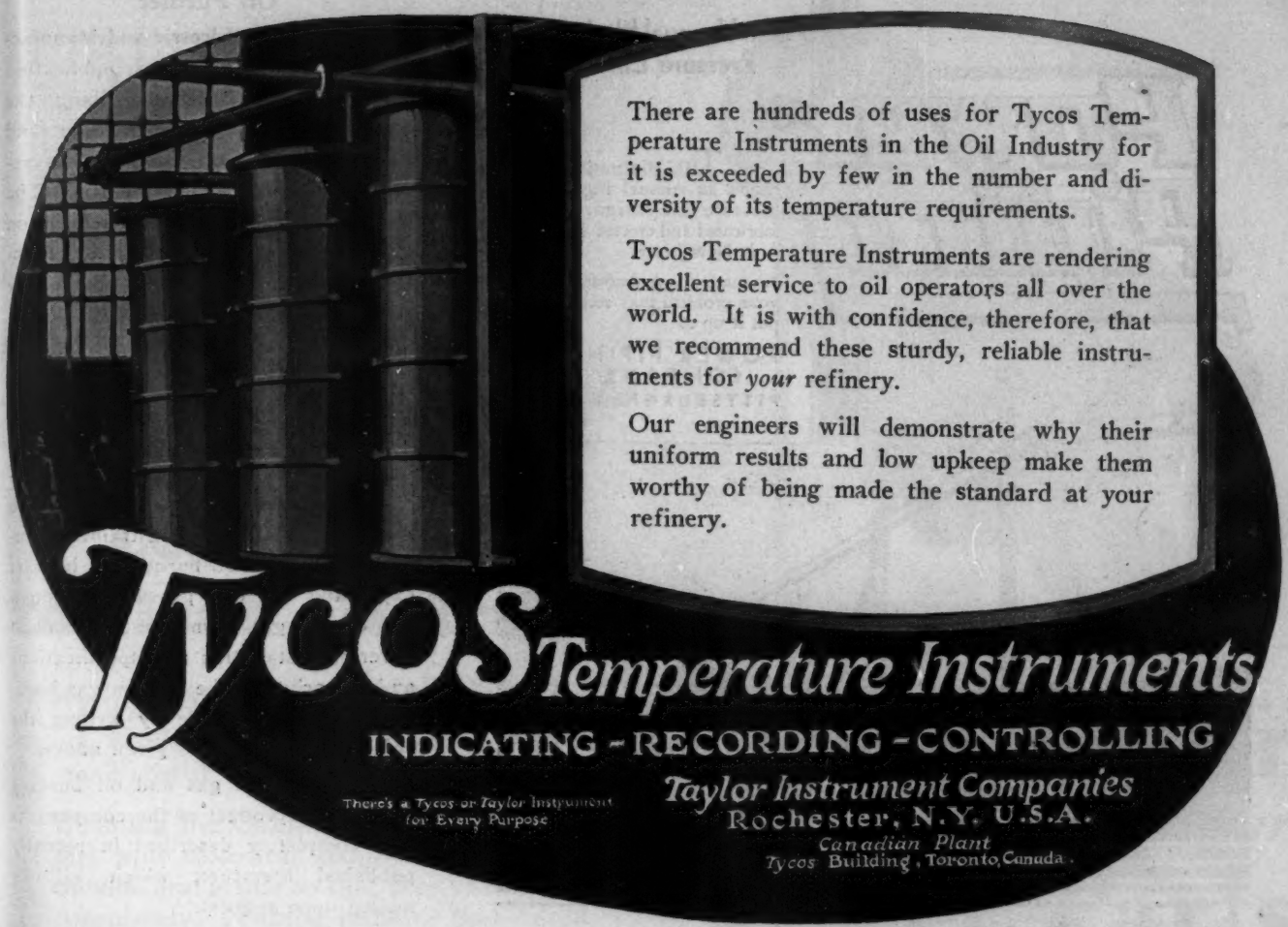
Anticipatory Recording Controller

LEEDS & NORTHRUP COMPANY

Leeds & Northrup Company, Philadelphia, is marketing its anticipatory recording controller, a fully automatic instrument for regulating temperatures of high-pressure fractionating tower or stabilizer. It is designed to maintain the temperature accurately and constantly regardless of the amount of non-condensible gas that is being charged to the tower. The principal piece of equipment used is a Leeds & Northrup recording potentiameter pyrometer controller, fitted with a device that anticipates temperature conditions. A double-motor, balancing, three-position valve drive, with relays and valve, are included.



Anticipatory Recording Controller



There are hundreds of uses for Tycos Temperature Instruments in the Oil Industry for it is exceeded by few in the number and diversity of its temperature requirements.

Tycos Temperature Instruments are rendering excellent service to oil operators all over the world. It is with confidence, therefore, that we recommend these sturdy, reliable instruments for *your* refinery.

Our engineers will demonstrate why their uniform results and low upkeep make them worthy of being made the standard at your refinery.

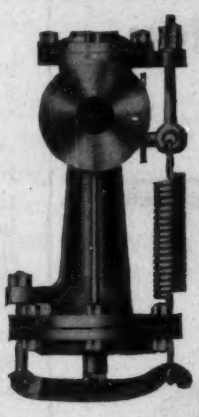
Tycos Temperature Instruments

INDICATING - RECORDING - CONTROLLING

There's a Tycos or Taylor Instrument for Every Purpose

Taylor Instrument Companies
Rochester, N.Y. U.S.A.
Canadian Plant
Tycos Building, Toronto, Canada

Specify AULD REDUCING VALVES



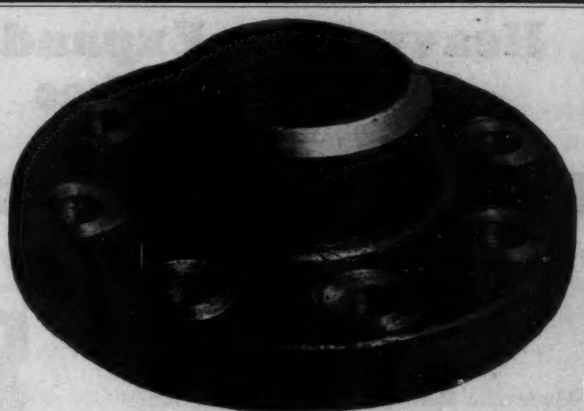
for steam lines where pressures must be reduced

Diaphragm actuated. Spring adjustment. Brass, Iron and Steel.
Sizes ½" to 5"

Send for new Bulletin 8-R

SCHUTTE & KERTING 1253 N. 12th Street PHILADELPHIA, PA.

See our Gear Pump ad on page 175



BUTT WELDING FLANGE

For All Welded Pipe Lines
Sizes 3" to 30" diameter, all standards.
Send for data sheets 29-14, giving dimensions.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS — CHICAGO
Box 485, Chicago 50 Church St., New York
"For more than twenty years the largest manufacturer of forged steel pipe flanges."

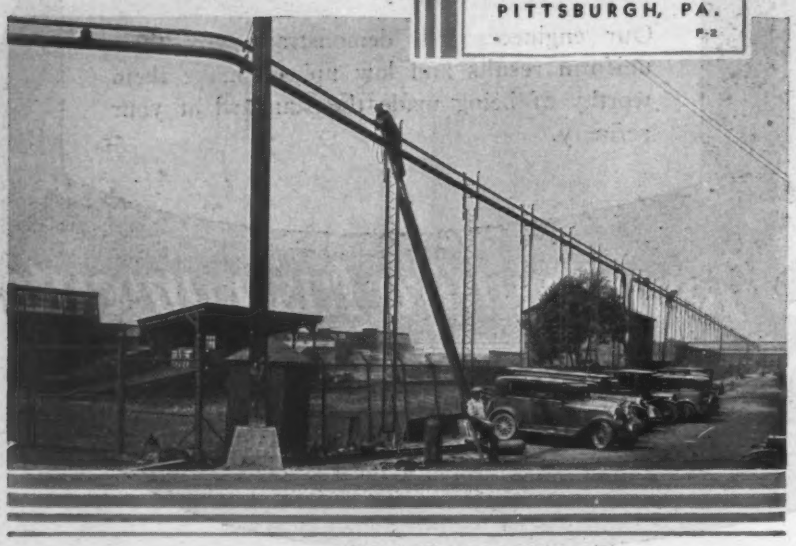
Power Piping
FOR EVERY INDUSTRIAL NEED

An Unusual High-Pressure Line

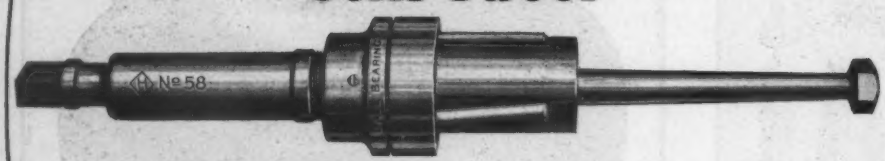
THIS illustration shows an unusual high-pressure line designed, fabricated and erected by us in New Jersey.

No matter how abnormal your problem may seem, put it up to

POWER PIPING COMPANY
PITTSBURGH, PA.



Heavy Duty Expanders for Still Tubes



Tools for the Oil Industries

Hydraulic Pressure Pumps, 8000 pounds
Tube Expanders for Cracking Still Tubes
Hydraulic Pressure Pumps, 2000 pounds
Tube Expanders for Condenser Tubes
Hydraulic Pressure Pumps, 500 pounds
Tube Expanders for Steam Boilers
Screw Punches for Structural Shapes
Tube Expanders for Pipe Work
Screw Punches for Plate Work
Flaring Tools for Still Tubes
Beading Tools for Still Tubes
Hydraulic Jacks
Hydraulic Punches

A. L. HENDERER'S SONS
Wilmington, Del.
Established 1870
Expanders since 1884

Oil Purifier

Westinghouse Electric and Manufacturing Company announces publication of Leaflet No. 20,442 describing the combination Sharples centrifuge and filter-press oil purifier which has recently been placed on the market. The leaflet contains a detailed description of the construction and manner of operation of the purifier accompanied by several pictures and diagrams.

Mettler Burner

Lee B. Mettler Company, 406 South Main Street, Los Angeles, has published a brochure titled "The Challenge to Waste," which is devoted to describing the Mettler entrained combustion gas and oil burner. A booklet explaining reduced gas bills through use of the gas burner and a booklet covering installation and specifications and blueprints of the Mettler gas burners are also available by writing the company headquarters given above.

A combination gas and oil burning unit, a new product of the company, is also completely described in recently published literature, which will be mailed upon request.

Air Preheater

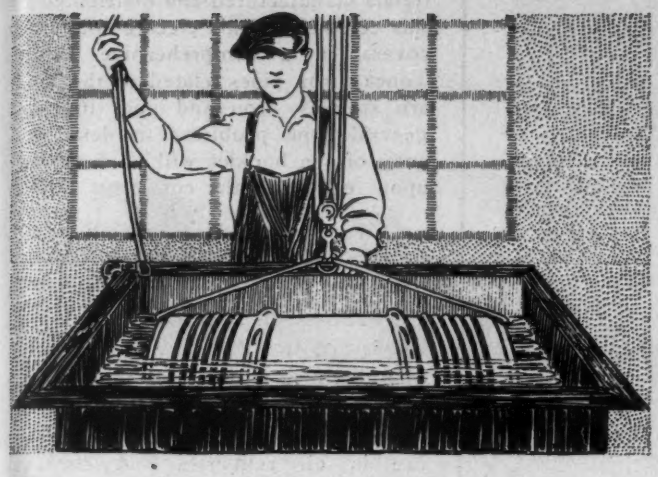
A bulletin on the Ljungstrom air preheater has been issued by Air Preheater Corporation, Wellsville, New York. This bulletin contains several charts illustrating the benefits obtained from air preheating, gives examples of the savings made under typical operating conditions, fully explains the functions and advantages of air preheaters, compares various types of equipment for this purpose, and discusses in detail the features of construction and special advantages of the Ljungstrom air preheater.

The bulletin is profusely illustrated with sectional views, diagrams and photographs of installations, and is exceptionally thorough in its presentation of all phases of the subject of air preheating.

Readers may obtain copies by addressing the corporation at the address given above, asking for Bulletin 130.

Toncan Iron Pipe

Republic Iron & Steel Company, Youngstown, Ohio, has recently published a 32-page booklet on Toncan iron pipe. Photographic illustrations showing Toncan iron pipe in the making and the finished products in use are used together with complete descriptions of all classes of Toncan iron ma-



Less trouble to clean oil drums

THE job of cleaning oil drums before refilling can be done easily and at small cost if Oakite materials are used.

Cleaning the Oakite way loosens grease, dirt and caked-on sediment from both outside and inside so that they rinse away completely. Nothing remains that might affect the grade of the new oil. Safe, too. Water solution eliminates fire danger.

Our booklet "Oakite in the Oil Industry" gives facts and formulas for this and many other oil-industry cleaning jobs: such as cleaning parts before salvage, cleaning storage tanks, and stripping paint from drums and tanks before repainting. Let us send you a copy.

Manufactured only by

OAKITE PRODUCTS, INC., 50B, Thames St., New York, N. Y.

Oakite Service Men, cleaning specialtists, are located at

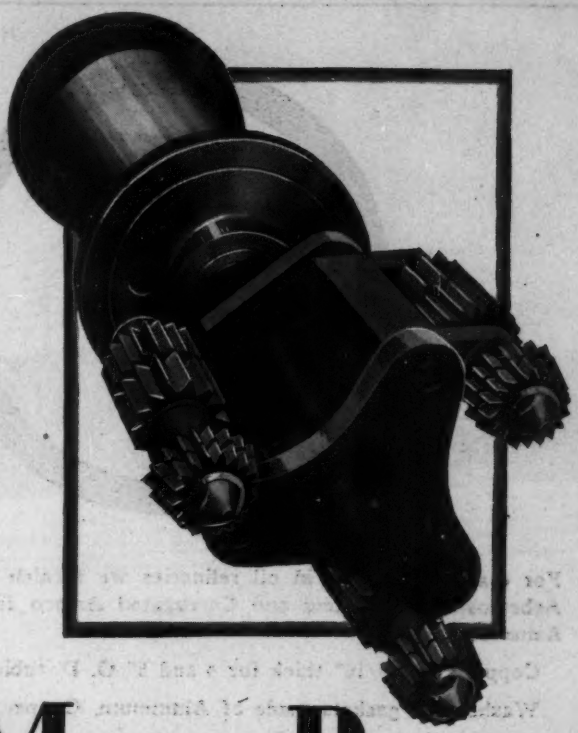
Albany, N. Y., Allentown, Pa., *Atlanta, Baltimore, Battle Creek, Mich., *Boston, Bridgeport, *Brooklyn, N. Y., Buffalo, *Camden, N. J., Charlotte, N. C., Chattanooga, Tenn., *Chicago, *Cincinnati, *Cleveland, *Columbus, O., *Dallas, *Davenport, *Dayton, O., Decatur, Ill., *Denver, *Des Moines, *Detroit, Elmira, N. Y., Erie, Pa., Fall River, Mass., Flint, Mich., Fresno, Calif., *Grand Rapids, Mich., Harrisburg, Pa., Hartford, *Houston, Texas, *Indianapolis, *Jacksonville, Fla., *Kansas City, Mo., *Los Angeles, Louisville, Ky., Madison, Wis., *Memphis, Tenn., *Milwaukee, *Minneapolis, *Moline, Ill., *Montreal, Newark, N. J., Newburgh N. Y., New Haven, *New Orleans, La., *New York, *Omaha, Neb., *Oakland, Cal., *Oklahoma City, Okla., *Philadelphia, Phoenix, Ariz., *Pittsburgh, Pleasantville, N. Y., Portland, Me., *Portland, Ore., Poughkeepsie, N. Y., Providence, Reading, Pa., Richmond, Va., *Rochester, N. Y., Rockford, Ill., *Rock Island, Sacramento, Calif., *San Francisco, *Seattle, Springfield, Mass., South Bend, Ind., *St. Louis, *St. Paul, Syracuse, N. Y., *Toledo, *Toronto, Trenton, *Tulsa, Okla., Utica, N. Y., Youngstown, Ohio, Williamsport, Pa., Worcester, Mass.

*Stocks of Oakite materials are carried in these cities.

OAKITE

TRADE MARK REG. U.S. PAT. OFF.

Industrial Cleaning Materials and Methods



More Power *in the motor* Fewer Parts *in the head*

This is a new Liberty Cleaner and Cutting Head built to help oil refineries speed up tube cleaning, and reduce cleaner maintenance cost.

The motor is larger, with larger cylinder displacement, and it develops from 30 to 60 per cent more power than old style machines for the same size tube. The length of the cleaner is kept as short as possible so that the cleaner will not stick in a sagged tube.

The cutter head is the new Type "L." The arms swing out sufficiently so that one head will clean all sizes of tubes within an inch range,—a 4" head can be used for all tubes ranging from 3" I.D. to 4" I.D. It is of very simple construction. Arm pins and clips have been eliminated. Arms and spider are drop forged, making the head very rugged.

Motors and heads are made for large tubes,—5", 6", 8", etc.,—as well as standard.

Let us tell you about them.

LIBERTY MANUFACTURING COMPANY

Jeannette, Pa.

Z-1087

For cracking process in oil refineries we furnish Aluminum Armored Asbestos filled Gaskets and Corrugated Armco Iron or Monel Metal Asbestos encased.

Copper rings 3/16" thick for 4 and 5" O. D. tubing.

Washers or gaskets made of Aluminum, Copper and other Metals.

Write for Prices.

METALLO GASKET CO.

NEW BRUNSWICK, N. J.

Hy-Speed

EXPLOSION-PROOF MIXERS

Hy-Speed Portable Electric Mixers are the most efficient machines manufactured for blending, compounding, mixing or agitating all oils and liquid chemicals.

They clamp to any tank or vat in one minute and produce a more thorough, rapid mix . . . . more economically than by any other process. Capacities from five to 50,000 gallons.

Write for your copy of «The Hy-Speed Age» ..... the Solution of your Mixing Problems.

For mixing

LUBRICATING OILS

LIME AND OIL

FULLER'S EARTH & OIL

ALL LIQUID CHEMICALS

ALSOP ENGINEERING COMPANY

47 West 63rd St. New York City

terials manufactured and distributed by this company. This piece of literature covers, in a comprehensive nature, Toncan iron pipe, related to the modern stainless iron and goes into the general type problems in detail. A copy of the booklet will be furnished, upon request to the company.

Heat Exchangers

Schutte & Koerting Company, 12th and Thompson Streets, Philadelphia, has issued the February, 1930, edition of Bulletin 12-H, covering the Schutte-Koerting line of heat exchangers for liquids. These heat exchangers are for use in oil refineries and chemical plants. This February edition may be obtained by writing the company at the address given above.

Steam Jet Heaters

Schutte & Koerting Company, Philadelphia, has just published a bulletin carrying up-to-date information on the company's steam jet heaters for liquids. This bulletin supplants Bulletin No. 3-A, in the S&K catalog binder. The new bulletin may be obtained by writing the company's Jet department, marking the letter "File Reference No. 367."

Burners

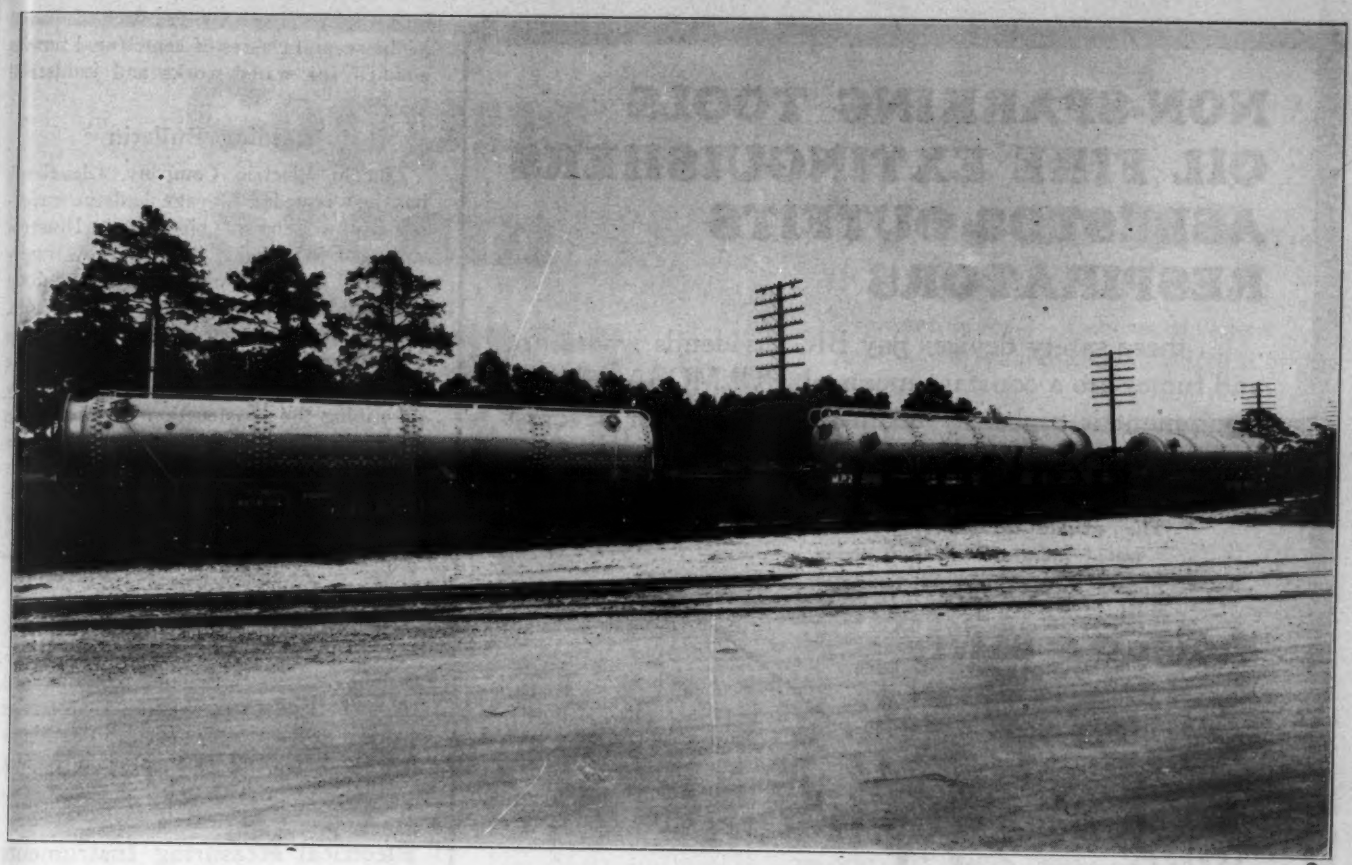
Peabody Engineering Corporation, 110 East Forty-Second Street, New York City, has just issued Bulletin No. 601, covering burners for oil, pulverized coal and gas. All burners of the company are described with illustrations, including Peabody-Fisher wide range oil burner, Peabody combined gas and oil burner, Peabody special gas and oil burner, Peabody Pioneer type coal burner, Peabody three fuel burner and Peabody Toronto type coal burner.

A copy of this bulletin may be had upon request to the company at the address given above.

Electric Pumps

De Laval Steam Turbine Company, Trenton, New Jersey, has issued a leaflet, "Successful Canadian Pumping Stations." This leaflet contains 28 pages of description and illustrations on these stations. Due to the extensive development of hydro-electric power in Canada, many of these stations employ motor driven pumps, in some cases, supplemented by gasoline engine driven standbys. Some of the larger plants, however, as in Toronto, are equipped with geared steam turbine driven pumps, while a few derive their motive power from hydraulic turbines.

A number of the electrically driven pumping units have shown over-all efficiencies from water to water of 86 per cent and over, according to the published statements. Large scale sectional draw-



Two Plants

To Serve Refiners and Natural Gasoline Manufacturers

TANKS — Pressure Vessels

Condenser Boxes — Absorber Towers

All Classes of Refinery Work

WYATT METAL & BOILER WORKS

Plants at Dallas and Houston

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WYATT

METAL & BOILER WORKS

NON-SPARKING TOOLS
OIL FIRE EXTINGUISHERS
ASBESTOS OUTFITS
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. . . . these safety devices pay BIG dividends where fire and fumes are a constant menace! PULMOSAN Safety Equipment is **especially** adapted to meet your severest requirements.

The coupon brings complete, illustrated literature. Mail it today.

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182 Johnson Street,
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"If It's for SAFETY We Have It."

Pulmosan Safety Equipment Corp.,
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Send us full information on refinery safety equipment.
Name .....

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SPARKL CLEANER
ACTS INSTANTLY

WITHOUT INJURY TO ENAMEL, PORCELAIN OR LACQUER SURFACES. OTHER GRADES FOR SPECIAL USES.

BOILER SCALE SOLVENT

For taking off scale in boilers and preventing incrusting salts in the water forming new scale, to be used while operating equipment.

ENGINE SCALE SOLVENT
Formula 2 2 2

For taking off scale formed on water jackets of Internal Combustion Engines, Condensers, Heaters, Pumps, Cooling Units, etc.

Ward Chemical Corporation
TULSA, OKLAHOMA

Branches:
OKLAHOMA CITY WICHITA FALLS

ings point out improved features of design in the several classes of centrifugal pumps adapted for water works and industrial service.

Welding Bulletin

Lincoln Electric Company, Cleveland, has just issued a 12-page bulletin covering arc welding of pipe lines. Illustrations carried in this bulletin show many views of welding work going on along lines under construction. J. F. Lincoln, president of Lincoln Electric Company has a six-page article in this bulletin on "Use of Electric Arc Welding Process," a story describing the construction of more than 3000 miles of pipe line. A page is given to inspecting and testing, and the various types of Lincoln "Stable-Arc" welders, including new and improved models, are described and illustrated.

Protective Coating

Quigley Furnace Specialties Company, 56 West 45th Street, New York City, is mailing out a descriptive circular and color chart on Quigley triple-A protective coating, and will gladly furnish this literature to interested persons upon request to the address shown here.

Electrical Measuring Instruments

Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, has recently issued catalog No. 20, 1930, edition, which is devoted to covering in illustrated form the company's electrical measuring instruments. Approximate characteristics of Leeds & Northrup galvanometers are tabulated throughout this catalog to make the itemized description more complete. Prices of the instrument are carried. Full details on operation of these instruments are also covered in the catalog.

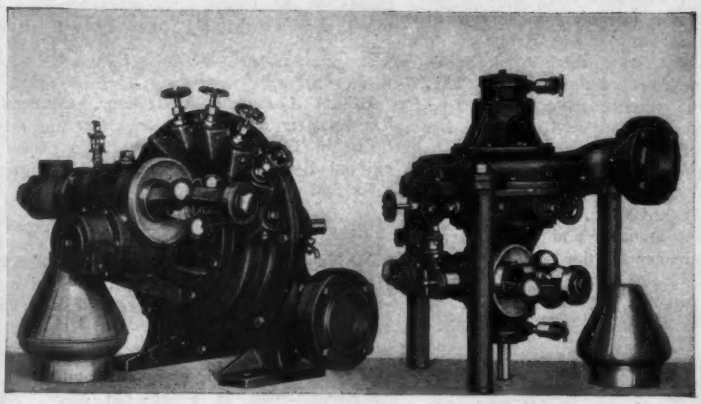
With this 40-page catalog, Leeds & Northrup Company has also issued three new bulletins. Bulletin No. 781 is devoted to covering the company's carbon dioxide meters (electrical). Attached to this bulletin is a chart showing a sample curve from the company's carbon dioxide recorder, showing a per cent carbon dioxide curve and a high temperature curve showing the degree Fahrenheit. This bulletin is also fully illustrated and carries charts on control of combustion, relation of carbon dioxide to excess air, a set of hydrogen in fuel, excess air and flue gas temperatures, loss due to excess air, thermal conductivity carbon dioxide meters, comments on design and a chart on the company's thermal conductivity cell.

Two other bulletins issued by the company are No. 536, which covers power cable fault bridge, and No. 950, the homo method applied to nitriding of steel.

Coppus Steam Turbines

1/4 to 60 H. P.

Explosion proof . . . Easy speed control . . . Rugged, reliable and low priced . . . Best steam economy . . . giving power without cost when used as "reducing valve" for heating or process work . . . Exhaust steam free from oil.

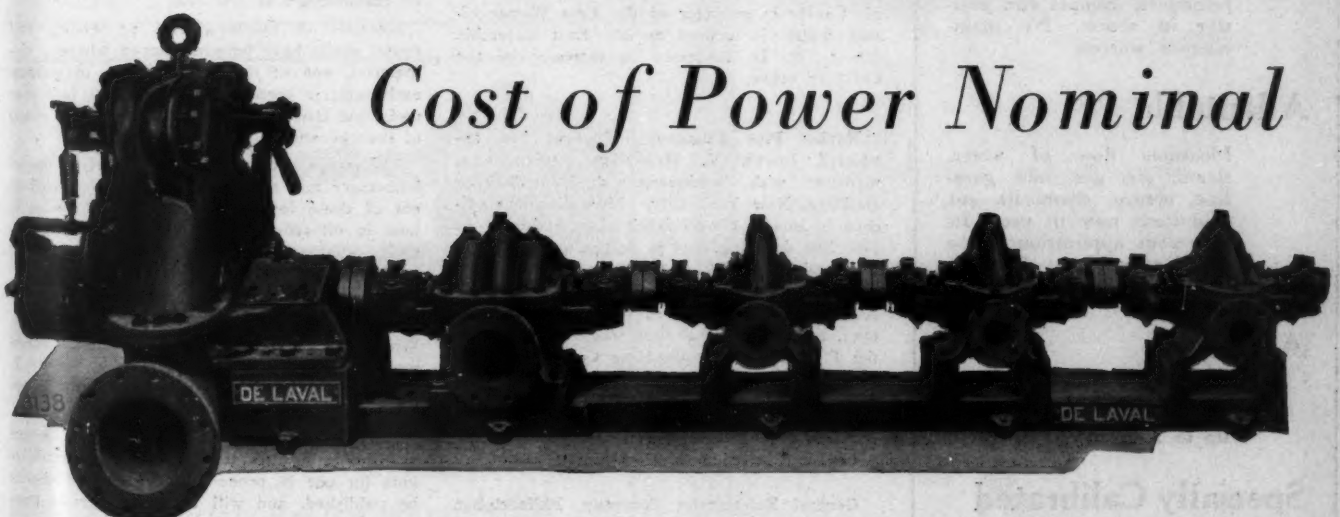


Horizontal **Vertical**

Read bulletin 135

Coppus Engineering Corporation
360 Park Ave., Worcester, Mass.

Cost of Power Nominal



THE DE LAVAL TURBINE here shown receives steam at 160 lbs. pressure and exhausts under 22 lbs. back pressure to an oil refinery process.

The DE LAVAL CENTRIFUGAL PUMPS are designed to handle respectively 1000 gals. per min. of water against 70 ft. head, 175 gals. of lean oil of .71 specific gravity at 140° F. against 254 ft. head, 185 gals. per min. of rich oil of .81 specific gravity at 90° F. against 157 ft. head and 60 gals. per min. of reflux of .8 specific gravity at 120° F. against 68 ft. head. A positive acting pump was formerly used in this work exclusively, but the turbine driven centrifugal pumps have proved superior in every way.

De Laval pumps are manufactured to limit gages on an interchangeable basis. All parts are made of material best adapted to the respective purposes. A guarantee of characteristics is backed by thorough testing at the works. *Ask for catalog B-116.*

De Laval Steam Turbine Co.

LOCAL OFFICES

Atlanta, Boston, Charlotte, Chicago, Cleveland, Duluth, Havana, Helena, Honolulu, Houston, Kansas City, Los Angeles, Montreal

Trenton, New Jersey

New Orleans, New York, Philadelphia, Pittsburgh

LOCAL OFFICES

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Manufacturing Engineers

922 So. Hemlock Street,

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ITEMS ABOUT MANUFACTURERS

American Air Filter Company, Inc., after April 1, represents the merging of Reed Air Filter Company, Midwest Air Filter Company and National Air Filter Company, into one organization. Formerly American Air Filter Company, Inc., was the holding company for the former three.

Arco Company of Cleveland has selected Los Angeles as the location for its new paint plant to serve the Western, Latin American and the Oriental trade, according to an announcement made by S. D. Wise, president, and S. D. Weil, vice president, following a survey of Western and export business conditions.

The plant will consist of three brick buildings totaling 16,500 feet of floor space. This will include a paint manufacturing plant 100 by 100 feet, a lacquer plant 50 by 100 feet and a varnish plant 30 by 60 feet.

The new factory will be known as the Arco Company, Ltd., of California, and will be under the direction of Howard Wise. Howard Raeney will be general sales manager and E. B. Hagar, who has been manager of the San Francisco branch, will be district manager with headquarters in Los Angeles.

Lincoln Electric Company, Cleveland, manufacturers of stable-arc welders and Linc-Weld motors, has announced the opening of new offices in Saginaw, Michigan, Fort Wayne, Indiana, and Oil City, Pennsylvania.

The Saginaw office is located at 338 Barnard Street, and is in charge of J. E. Luter. D. H. Carver is manager of the Fort Wayne office, which is located at 225 East Columbia Street. E. D. Anderson is manager of the Oil City office.

Naylor Pipe Company, Chicago, has appointed Joseph V. McMullan foreign sales manager with headquarters at 3116 Chrysler Building, New York City. McMullan's experience in iron and steel fabricating, hydraulic or pipe line dredging, and in design and construction and operation of hydraulic dredges dates back many years. Since 1926 he has served Naylor Pipe Company in the New York district, and prior to that time was connected with the T. S. Marvel Shipbuilding Company, James Stewart & Company, Morris Machine Works and the Gahagan Engineering Company. He will continue as New York district sales manager in addition to performing his new duties.

General Refractories Company, Philadelphia, announces the acquiring of all the refractories properties of Evans & Howard Fire Brick Company, St. Louis. The latter company has been a leading manufacturer of fire brick since 1857, having plants located at St. Louis and Stevens Pottery, Georgia, with a combined daily capacity of 180,000 bricks. The purchase includes large tracts of clay lands in Missouri and Georgia.

The recent acquisition gives General Refractories Company a total of 18 modern plants having a daily capacity of 1,200,000 bricks.

The Evans & Howard Fire Brick Company refractory plants will be operated by the purchaser as the Evans & Howard Division, and the brands of the old company will be continued.

Bristol Company, Waterbury, Connecticut, has recently opened a new sales and service office in Los Angeles, with S. W. Case appointed district manager and W. H. Rogers as sales and service engineer.

Haden Lime Company, 1720 Shepherd Street, Houston, has the only plant of its kind in the world, making lime from oyster shells by burning in a rotary kiln.

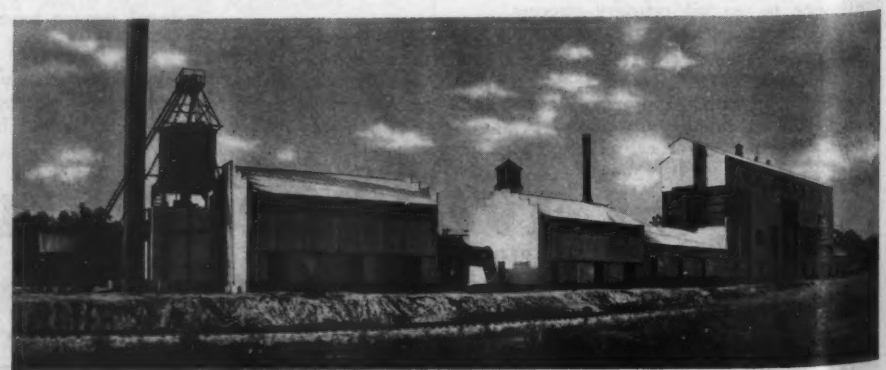
The construction and successful operation of this plant is the culmination of long study and experimentation, in which the object sought was the production of a lime of the highest degree of purity, with a standardized uniformity of composition that would place it in the class of high-grade chemical reagents, and still allow its manufacture at low cost.

Methods of handling and processing reef oyster shells have been developed whereby this material, one of the purest forms of calcium carbonate, is economically converted into lime under the strictest chemical control at all stages of the operation.

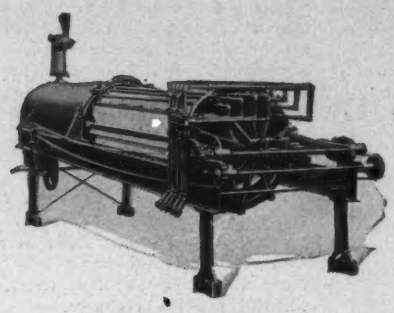
The company maintains a completely equipped laboratory and service department for the benefit of those interested in any of the uses of lime in oil refining, natural gasoline manufacturing, grease making, construction or chemical industry.

Directing activities of the Haden Lime Company are: W. D. Haden, president; W. A. Wansley, vice president; C. R. Haden, general manager; E. D. Haden, secretary; Sidney P. Armsby, service director; T. A. Evans, chemist, and W. G. Carlston, superintendent.

Literature covering the results of several years of study to develop a special grade of lime for use in process industries will shortly be published, and will be mailed gratis upon request to the above address.



Haden Lime Company Plant



And All for a Few Cents a Barrel . . .

RESIDUUM, as it comes from the pressure still, is worth how much?

Treated so that it passes the B. S. Benzol Test for fuel oil and then what is it worth?

The Kelly Filter will make this transformation for you at small cost. In every instance so far operating costs have been but a few cents a barrel.

Why not investigate this matter further?

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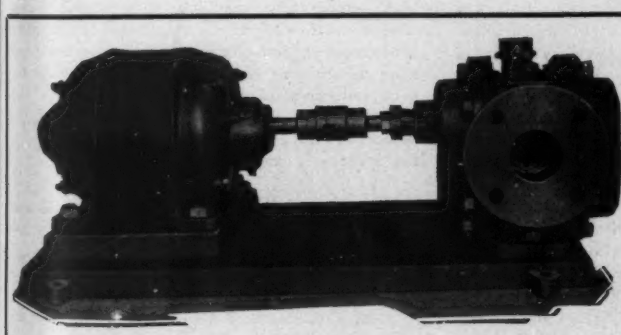

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S & K GEAR PUMPS are built to handle oils—light or heavy, hot or cold.

7 Std. sizes. Capacities ½ to 150 g.p.m.
Pressures up to 250 lbs.

Bulletin 17-A gives complete information.

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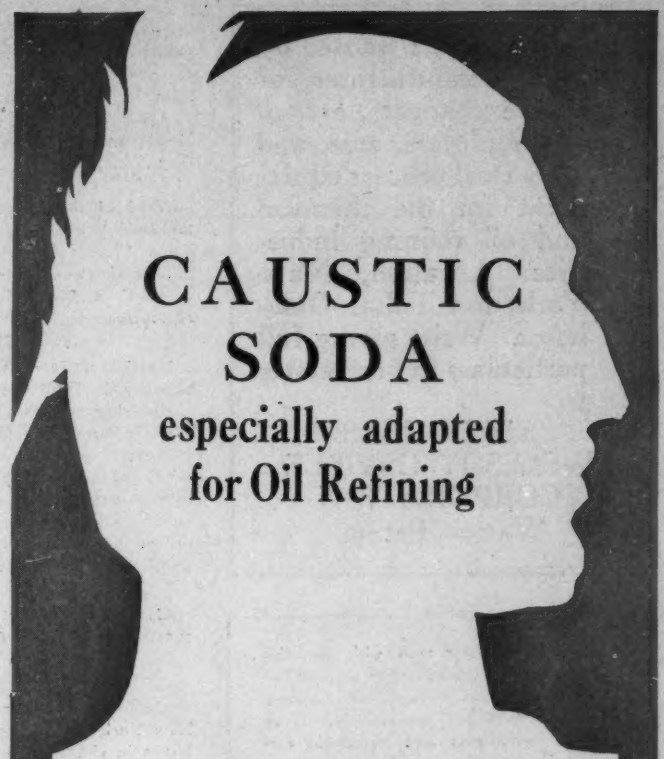
See Our Reducing Valve ad on Page 167



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Also Manufacturers of Soda Ash—Calcium Chloride—Bicarbonate of Soda

NOTE NEW ADDRESS: Our new location in New York is at 10 East 40th Street — just across the street from where we were and a few steps nearer Fifth Avenue.

Sales Engineers wanted by large manufacturer of heat exchangers, evaporators, dryers, steel and alloy steel process equipment for the chemical and oil refining industries. Location, New York and Tulsa, Oklahoma. Write giving full particulars in first letater to

STRUTHERS WELLS-TITUSVILLE CORPORATION
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WANTED:—Young man with operating and engineering experience in the Oil Refining Industry, to become Sales Engineer for long established manufacturer of recording instruments and automatic controllers for temperature and pressure (both air and electrically operated types). Candidates preferred who have had both industrial experience and scientific education, and who are free to travel through the great industrial districts. Highest character references required. Write, stating experience, age, and salary desired. Box 9790, care Refiner and Natural Gasoline Manufacturer, Houston, Texas.

Electrically Driven Centrifuges
Hand Centrifuges
WRITE
WILLIAMS, BROWN & EARLE, Inc.
Manufacturers of Laboratory Apparatus
918 Chestnut St. Philadelphia, Pa.

TANK CARS BOUGHT, SOLD, LEASED AND REPAIRED
Repair Parts (including whole trucks) for tank and freight cars of all kinds.
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(Chicago Suburb) East Chicago, Ind.
"A trial is all we ask"

DOME COVERS AND OUTLET CAPS

Made to A. R. A. Specifications. Instant shipping service. Write, phone or wire.
Western Iron & Foundry Co., Wichita, Kan.

For Sale—GATE VALVES
Ranging in size from 3" to 30". Good condition. Priced to move quickly. Also quantity of Pipe, Tees, Elbows, Etc.
BRIGGS & TURIVAS, INC.,
Blue Island, Ill. (Suburb of Chicago)

Sewell Paint and Varnish Company, Kansas City and Dallas, has given H. E. Hancock supervision over industrial sales, which means that he will actively direct the company's efforts in the oil industry, under direction of Eugene D. Liddy, general sales manager. Headquarters of both gentlemen are at Kansas City.

Ward Chemical Corporation of Tulsa has established branch office and warehouse at Oklahoma City. The company also maintains a branch and warehouse at Wichita Falls, Texas, where C. R. Goodrich recently was named sales representative.

Quasi-Arc, Incorporated of New York, has announced establishment of a consulting field engineering service to work in connection with Welders Supply Company of Tulsa, Dallas and Houston, distributors of the company products. Hugh J. Boyle has been named consulting engineer in connection with the new service. Herman L. Ammann, technical director of Quasi-Arc, is on a tour of the Mid-Continent and northern and eastern fields.

Alsop Engineering Company moved to new quarters at 39 West 60th street, New York, on April 1.

Smith Engineering Company has opened a New York office at 90 West Street, with T. C. Banta in charge.

Connersville Blower Company, Inc., Connersville, Indiana, has awarded the contract for the immediate construction of a 25x125 foot addition to its Victor department. This additional space will be used for rearrangement of equipment in the production of Victor rotary positive blowers and gas pumps, also Connersville meters, of the smaller capacities which are applied to an increasing number of industrial processes, including combustion in oil or gas burners, seration and agitation of liquids, pneumatic tube systems and as auxiliary parts of special machinery.

Tube-Turns, Inc., Louisville Kentucky, has recently appointed the E. F. Keating Company, 452 Water Street, New York City; Himelblau-Agazim & Company, 30 North Dearborn Street, Chicago, and Stewart Machinery Company, Buder Building, St. Louis, as distributors for the company's products in those respective territories. Each of these companies will carry a complete stock of Tube-Turns in 45, 90, and 180 degree types. W. P. Curley and A. L. Breyvogel will continue as managers of the New York and Chicago branch offices respectively.

Cooper-Bessemer Corporation has announced establishment of an office in Houston, at 505 Esperson Building, in charge of R. H. Dale. Other offices of the company in Texas are at Dallas, Amarillo and Borger. Dale is a native Texan and a graduate in electrical engineering from the University of Texas. In 1918 he served as superintendent of the engine division in the army school of automotive mechanics. From 1919 until this year he was sales engineer with the Tennant Company at Houston, specializing in the application of compressors and centrifugal pumps for producing and refining departments of oil companies and also in heat exchange equipment for refineries.

R. H. DALE

Sarco Company, Inc., 183 Madison Avenue, New York Manufacturers of steam traps and heating specialties, has announced the appointment of Gus A. Binz as manager of sales and advertising. Mr. Binz was for eight years manager of sales and advertising for American Schaeffer & Budenberg Corporation, and previously sales manager of Yarnall-Waring Company, Philadelphia.

Foxboro Company, Foxboro, Massachusetts, announces the removal of its Los Angeles office to 2307 East Eighth Street, to give Southern California the engineering service offered by the company in the other territories. Dudley M. Hill will be in charge.

Eagle-Picher Lead Company has announced the opening of a new office and warehouse in Dallas, located at Jefferson and Caruth Streets, to better meet the needs of the Southwest market.

The Bristol Company, Waterbury, Connecticut, has issued Catalog No. 1009, covering Bristol's recording pressure and vacuum gauges. The catalog gives complete and up-to-date information on this particular division of the company's recording instrument line. This issue is available upon request to The Bristol Company's headquarters.

"Falcon" electrically heated compound melting tank, manufactured by H. O. Swoboda, Inc., consulting electrical and mechanical engineers, 3400 Forbes Street, Oakland Station, Pittsburgh, is described in an article which appeared in the February issue of Fuels & Furnaces. Reprints of this article are being mailed to interested persons upon request to H. O. Swoboda, Inc.

Stockham Pipe & Fittings Company, Birmingham, Alabama, is marketing the new Stockham Fantz-type bend for high pressure, high temperature cracking stills. The design stresses ease with which it can be taken down for inspection and cleaning. It is a stream line flow design to effect approximately a 25 per cent reduction in pressure drop losses. One tube may be replaced without disturbing the adjacent tube. All parts of all bends are of the same size and are interchangeable.

Stratford Engineering Company of Kansas City has placed Mid-Continent sales under the direction of W. R. Layne, who will make headquarters in Tulsa. Mr. Layne was in Houston prior to his transfer to Tulsa. He was formerly with the Standard Oil Company of California and later with the Byron Jackson Engineering Company.

Barrett, Haentjens and Company, Hazleton, Pennsylvania, has issued a complete set of bulletins, bound in loose-leaf form, describing the most effective means for priming centrifugal pumps manually. The following subjects are fully covered in these publications, and are available upon request to the above address: The Theory of Priming; Submerged Pumps; The Use of Foot Valves; Air, Steam and Water Ejectors; Hand Operated Priming Pumps; Motor Driven Priming Pumps; and Arrangement of Intake Piping.

General Paint Corporation, 115 Davis Street, San Francisco, has published a loose-leaf folder containing a revision of prices on mill coated and wrapped pipe and which cancels all prices heretofore quoted. Particular attention is given to the revision of prices on sizes for one-half-inch to 3½-inch pipe inclusive, and on all sizes for quantities less than 20 miles. Quotations are also presented on several new specifications which the company has been required to furnish to meet present conditions. The revision is made to March 25, 1930.